

The Milbank Memorial Fund

QUARTERLY

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IN THIS ISSUE

DURING recent years there has been an increasing awareness of the problems of prevention and control of the chronic diseases. This is true of professional workers in the field of health and also of the general public. Early in 1952 the "Joint Committee on Chronic Disease Statistics" was appointed by the Officers of the Epidemiology and Statistics Sections of the American Public Health Association. Its membership is composed of representatives from each of the two Sections.

Members of the Committee conducted a panel discussion at the last Annual Meeting of the American Public Health Association in October, 1952. The general topic of the discussion was "Problem Areas of Interest in Chronic Disease Studies."

The six papers which were presented by the panel members are contained in this issue of the Milbank Memorial Fund *Quarterly*. They are as follows: "Team Endeavor in the Study of Chronic Disease" by Dr. John E. Gordon; "Identification of Cases of Chronic Disease" by Dr. P. E. Sartwell; "Measurement of the Progression and Regression of Chronic Disease" by Dr. Robert Dyar; "The Selection of a Universe for the Study of Chronic Illness" by Felix E. Moore; "Resources Which Can Be Tapped for Long-Range Studies of Chronic Disease" by Herbert H. Marks; and "Long-Range Studies of Mental Hospital Patients" by Morton Kramer.

Each of these papers contains a discussion of problems in a specific area of interest in the field of chronic disease control.

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The paper "On the Association Between Health and Social Problems in the Population" by Antonio Ciocco, Paul M. Den-

sen, and Daniel G. Horvitz is the first report of a study aimed at determining the degree and nature of association between ill health and problems of concern to social agencies in the community. The study is being conducted in a sample of families in the Arsenal Health District of the City of Pittsburgh, Pennsylvania.

This paper describes the methods of the study and presents some of the preliminary findings. This investigation is of special interest because it aims to go more deeply into the study of the relationship between social and health characteristics than has been true of most investigations of morbidity.

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The article by Charles F. Westoff, Lee F. Herrera, and P. K. Whelpton entitled "The Use, Effectiveness, and Acceptability of Methods of Fertility Control" is the twentieth in a series of analytical reports from the Indianapolis Study on the Social and Psychological Factors Affecting Fertility. This particular report is not organized in terms of any specific hypothesis, but rather attempts to analyze the practice, effectiveness, and acceptability of methods of contraception as used by couples in a "normal" population. In the hope of shedding more light on the general subject of differential fertility in the United States, particular attention is devoted to analysis of the data by income groupings.

PROBLEMS OF TEAM ENDEAVOR IN THE STUDY OF CHRONIC DISEASE

JOHN E. GORDON, M.D.

BY TITLE, team endeavor is here restricted to its research potentialities, specifically excluding all relation to operational programs for prevention and control of chronic disease, or for evaluation of control measures. Administrative practice in public health, whether by official or voluntary agencies, has found team endeavor so useful that it has become accepted procedure.

Operational epidemiology, as practiced by health departments, has become a team effort. The basic elements of the team are drawn from representatives of epidemiology and the laboratory, and from clinical skills to include those of the veterinarian and the dentist. The work of the day is largely done by the public health nurse and by sanitarians and other technically trained assistants. The entomologist, the sanitary engineer, the geneticist, and all manner of specialists in both biological and social sciences may participate according to the problem in hand. The accomplishments are such as to suggest to some that team endeavor is the prescription for all ills and all patients, including research.

Chronic disease is widely inclusive of many pathological conditions. Causality, viewed as a problem of populations, rests in many areas. In attempted solution of the unknown, public health has its own basic disciplines with their bodies of verifiable facts and resulting systems of logical inferences. Public health has always drawn heavily on other sciences, and broadly also; from biological, medical and the natural sciences, and more recently from the social disciplines. The practice is usual in science.

The demonstrated value of knowledge and methods derived from other sources led naturally to active collaboration of workers in different fields of science. An interdisciplinary approach to problems has been so successful at times as to give rise to a

new discipline, biophysics for example. Group or team effort in research is the modern trend. It has the danger of becoming a fetish. Like most things, team endeavor presumably has its uses and misuses, its values and its limitations.

Team Endeavor in Chronic Disease. Neither evidence nor reason suggests any more or any less advantage to team endeavor in the study of chronic disease than in other areas of research in public health. Attempt is now made to sort out the attributes of team endeavor and to recognize guides for conduct and procedure best suited to use of that system in study of community disease of chronic nature. Because principle would seem to apply here as elsewhere, examples and experience are drawn from a variety of investigative fields, in the belief that inferences of greater strength are possible than through attention to the restricted and relatively undeveloped interest which has immediate attention.

Research Fields. I find need at the beginning to distinguish two broad fields of research. They are easily labelled, difficultly characterized and perhaps impossible of complete separation. Drawing on that experience to me most expressive of the differences entertained, I should call them strategic and tactical. The first has to do with the origin of an idea, the development of a conceptual scheme, the planning of experiment and the accumulation of the necessary evidence to test a stated hypothesis. The second is the enlargement and extension of knowledge essential to bringing the facts to practical usefulness. Should I use the jargon of the day, I would call the two divisions research and development. I have a liking for simple words and suggest discovery and invention. I might to advantage maintain my academic role, in which case I mean basic and applied research.

I avoid further venture into semantics and turn to well-known illustrations. Banting discovered insulin, although as is usual he built on bits and pieces of fundamental information accumulated by others over many years. MacLeod, Best, Collip, Joslin, and many others made it a useful and practical addition to materia medica. Boyle's law was a great discovery, the steam

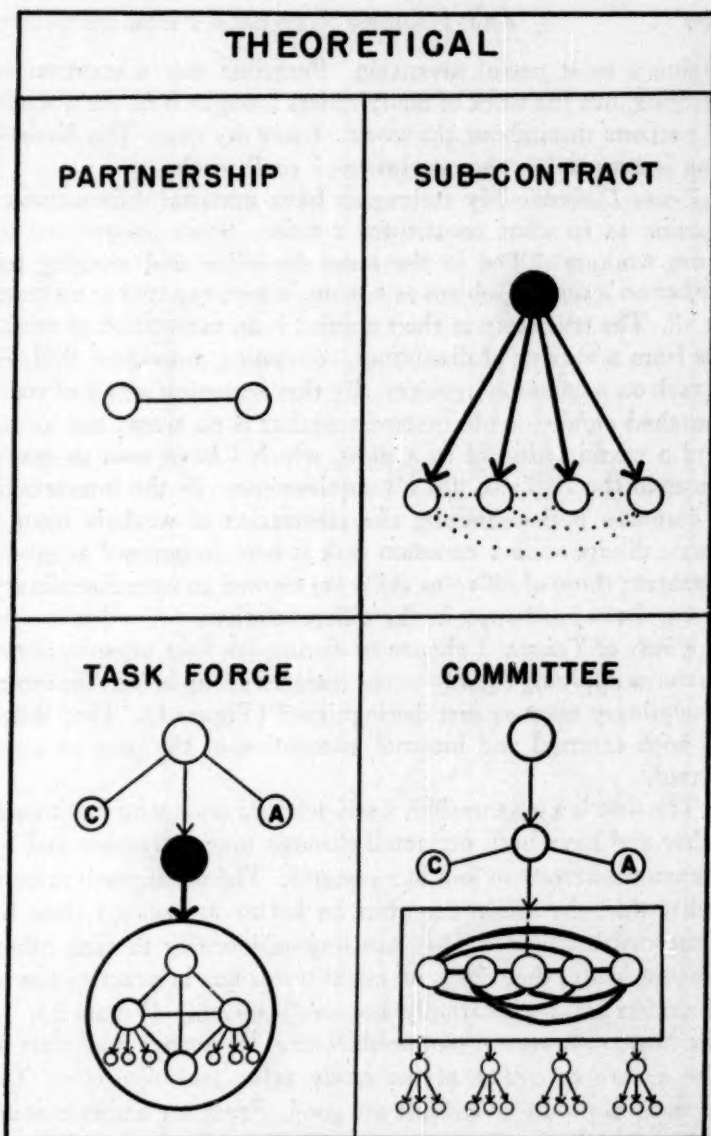


Fig. 1. Team endeavor in research, external and internal reaction patterns; theoretical concept of organizational groups. A is advisory committee, C is consultants. Circles represent individuals within an organization and lines show the direction of authority and interaction. Shading of circles represents degrees of authority and the various lines the strength and frequency of interaction.

engine a most useful invention. Penicillin was a creation of Fleming, but the work of many others brought it to the bedside of patients throughout the world. I rest my case. The distinction is essential to the conclusions I shall reach.

Team Defined. My colleagues have material differences of opinion as to what constitutes a team. Some accept two or more workers skilled in the same discipline and working together on a single problem as a team; others say that is no team at all. The true team in their opinion is an association of workers from a variety of disciplines, combining individual skills in attack on a common problem. By this reasoning a pair of well-matched percherons harnessed together is no team; but an ox and a woman hitched to a plow, which I have seen so many times in the Balkans, fills all requirements. In the interests of a common understanding, the association of workers from a single discipline in a common task is here recognized as group research; those of different skills are termed an interdisciplinary team. I am not happy in the differentiation.

Kinds of Teams. I choose to distinguish four organizational patterns applying equally to the research group and to the interdisciplinary team as just distinguished (Figure 1). They differ in both external and internal interaction of the persons associated.

The first is a partnership, a self-selected team who know each other and have been attracted through mutual respect and by common interests to join in a research. The usual motivation is belief that the study can thus be better prosecuted than by either worker alone. They are responsible only to each other. Theoretically, they work on equal terms but in practice one or the other almost invariably assumes leadership (Figure 2). In the best traditions of partnership, that leadership may shift as the nature or course of the study takes new direction. The chances of productive result are good. From my acquaintance-ship, I find illustration in the partnership of Topley and Wilson; Topley the biologist with his skill in developing conceptual scheme, Wilson the master of methodology and technic.

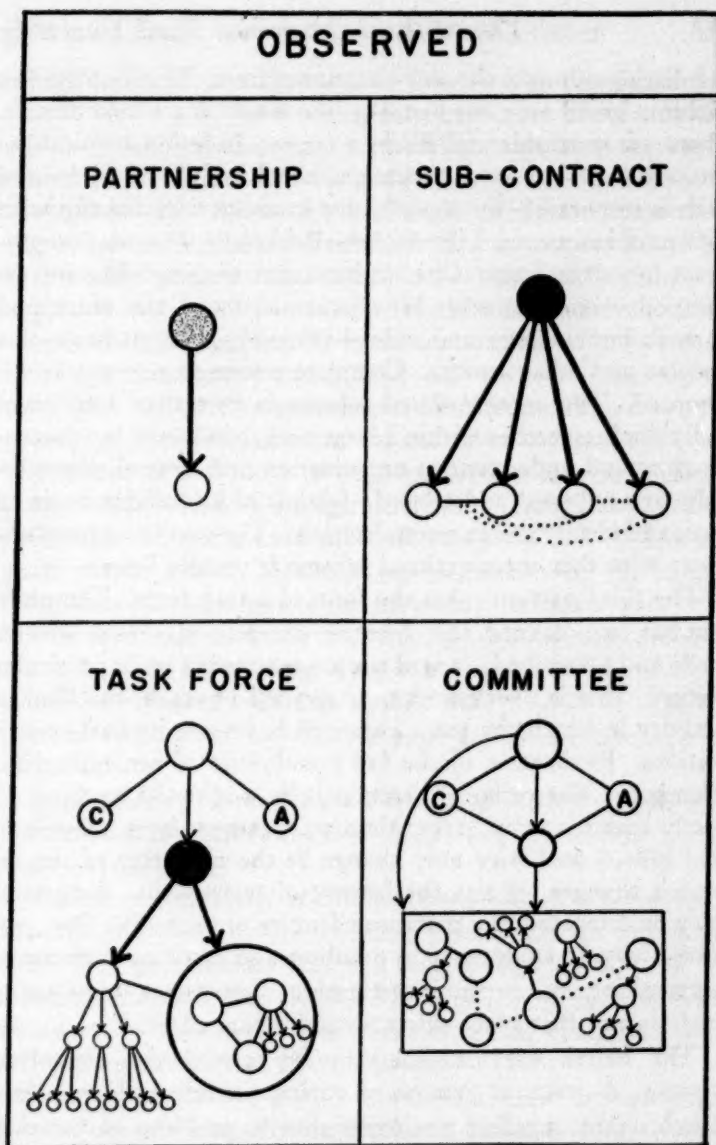


Fig. 2. Team endeavor in research, external and internal reaction patterns: commonly observed deviations in practice. A is advisory committee, C is consultants. Circles represent individuals within an organization and lines show the direction of authority and interaction. Shading of circles represents degrees of authority and the various lines the strength and frequency of interaction.

I distinguish next the sub-contract system. The problem lies within a broad area, for instance, the study of a whole disease. There are separable and distinct facets. Individual investigators are recruited by a director, allotted individual fields, and each is responsible for a particular investigation, usually with a corps of assistants. I think of the Rockefeller Foundation program in yellow fever. One worker takes responsibility for arthropod vectors, another for characteristics of the virus, and so with immunology and animal reservoirs, the qualities of a vaccine and other aspects. Complete coverage may not be attempted. The organizational scheme is in reality a series of individual researches within a large area, conducted by subcontractors and under central organization and control where results are collected and related. Islands of knowledge begin to fuse, and ideally end in generalization. The sum of accomplishment with this organizational scheme is usually large.

The third pattern takes the form of a task force. The problem has been defined, the objective determined. There is work to do and prescribed kinds of people are needed to do particular things. This is development, or applied research, the field of activity in which the team approach has made its best contributions. Realization of the full possibilities of penicillin after Fleming is illustrative. Direction is by a scientist working directly with the team, rather than management from a distance; and indeed authority may change as the character of the research changes, as was the history of terramycin. Subgroups may be delegated to a particular feature of the work. One subgroup may be augmented in numbers and emphasis because of a promising turn in the investigation. Sometimes items are of such nature that place exists for individual effort.

The fourth organization may be termed the committee system. A group of persons of varied training and experience are brought together to investigate a problem of common interest. This is an executive committee, charged with active prosecution of the research. The group is not to be confused with the advisory committee, which is something else with

wholly different functions; nor with consultants who usually function in a part time and special capacity. The committee works through a chairman, selected from or by the group of which he is an active member. Committees do not commonly come into being of themselves. Usually they are appointed by a person or an organization to whom they are responsible. They commonly report to an intermediate authority. Decisions as to approach and course of action in the research presumably rest on group consensus; but often the appointing body or its representative, in relative anonymity, really calls the tune. Operations tend to break down because of decisions weakened by compromise, a feature inherent to the committee system. The success achieved is usually through separation into self-selected partnerships within the larger structure, through work as individuals, or by organized sub-teams responsible for particular parts of the project although representatives of the various disciplines may continue to use each other as consultants (Figure 2). Factors commonly determining such divisions are similarity in background of the disciplines concerned and the personalities involved. This is usually the poorest of the four organizational patterns, whether intended for basic or applied research.

Application of Team Method. This brief analysis should give indication of my beliefs about team practice in research. I state them categorically:

1. That part of study of chronic disease which involves basic research has most promise when pursued through individual effort by a person with skill and imagination, an inherent interest in the field, and freedom to turn his energies in what direction he would. No symphony was ever composed by a committee; nor a great poem written.

Group research by multiple representatives of a single discipline selectively has value in solution of basic problems, that of the interdisciplinary team is likely to be less, and both function to best advantage under the partnership or sub-contract organization.

2. Investigation of chronic disease at the stage of development, as an applied research, is the special sphere of interdisciplinary team effort. The preferred organization is of the sub-contract or task force pattern. Group research has a place, functioning variously under the several patterns noted. Applied research by individuals is not outmoded.

Recently I had a part in an interdisciplinary team of two epidemiologists and two social scientists. The objective was to define method for study of mass mental disorder. Suicide provided the material. We found common profit and mutual assistance in many matters relating to the social environment, such as occupation and marital status, matters with which all were more or less familiar through use in our own particular disciplines. Everyone was impressed with the probable importance of social stress as an influence on suicide. Much consideration of how to identify and measure social stress led to full agreement that the question was not to be solved by our particular interdisciplinary effort, but was better suited to the talents of some individual worker from a social science.

Team Operation. The discussion thus far has been directed toward principle, primarily in team organization. Development and function, practical working procedure, leadership and direction, and the correlation of experiment with personality and inclination are such as to warrant separate consideration. These matters are beyond the scope of this presentation. However, they have such determining value in the success of team endeavor, that with little discussion or comment and with no attempt at arrangement in order of significance, I set down some of the factors that have appealed to me and more often to my colleagues, as contributing to comfortable and constructive conduct of team or group endeavor.

1. The theoretical ideal of a democratic association, with all team members having equal voice, rarely works out. Leadership is essential; and to advantage, authority is defined and distributed in such manner as to assure clear-cut direction. Interdisciplinary work brings stress. Where there is stress, all the

more need exists for strong leadership to give supervision, control and guidance. Informal leadership and initiative are, however, to be recognized and encouraged.

The frequent assumption that results and methods contributed by one member of a team are like pieces of a jigsaw puzzle, ready to fit the pieces produced by other members, lacks validity. Responsibility for analysis and coordination of research results and for recognition of suggestive leads, rests to advantage with some one person.

Although leadership is largely an innate characteristic, the director of an interdisciplinary team desirably is a person trained in more than one field. He has experienced some of the difficulties in cross-disciplinary work. The increasing practice of interdisciplinary investigation may have influenced Bode in urging the training of scientific generalists.

2. To collaborate effectively, members of an interdisciplinary team have the obligation to master the basic assumptions of other fields represented. Terms must become interchangeable. Life with our allies in Britain during the war years was much simpler with understanding that the roundabout in British parlance was the American traffic circle. Cross-disciplinary training is an important asset in favoring deeper exploration by single disciplines; but the commoner it is, the less the need for interdisciplinary team research.

3. Disciplines associated in a common investigation should have reached approximately equal stature. A strong discipline cannot always be expected to reinforce a weak one; it often suffers dilution.

4. Research is not done by disciplines but by people, and the problems undertaken come from life rather than the disciplines themselves. Association within a group does not relieve the individual of the obligation to think for himself.

5. Initial basic adjustment between team members requires consideration of (1) the appropriateness of the problem; (2) satisfactory criteria for identifying the unit of observation; (3) the means for measurement of observed phenomena; and

(4) different standards of evidence used by different disciplines.

6. Relatively few members of a team function comfortably and efficiently in all of the different situations in which interdisciplinary work is done. Their experience does not invariably fit, nor do tools of their trade always apply. Some are more at home in the field, others in the laboratory, a lesser number in the clinic and only a few face a mechanical calculator with composure.

7. Program planning with detailed attention to sequence and timing of short term steps toward a goal that has been set, clearly precedes staff recruitment or initiation of team study.

8. Whatever the type of problem and however the team is constituted, a pilot study is fundamentally useful in favoring success of the larger project. No interdisciplinary team comes into being, full-blown and adult, in the manner that Minerva stepped from the brow of Jupiter. At the risk of mixing my metaphors, to assemble a group, give them a football and promptly start the game invites fumbling, stress, and sometimes disaster. The more promising procedure is to start with two or three key members, add others by increments, test team position and capabilities, and then start work.

SUMMARY

Group research is distinguished from interdisciplinary team endeavor. Four organizational patterns are common to both. In basic research no form of multiple effort gives promise of supplanting individual activity, but group study is ranked above the interdisciplinary team. Both find greater usefulness in applied investigations, with this the particular field of the interdisciplinary team. Other than organizational pattern, choice of members, training in team effort and established lines of authority and interaction are factors strongly influencing success. Weaknesses are sufficiently general that I am encouraged to suggest a new kind of interdisciplinary team that might well find general favor. The suggestion stems from a need engendered by the present-day world. I suggest a working team

of two. One member withdraws to office or laboratory and gets on with the work of the day; the other, his chief qualifications being bulk and muscle, stands guard at the door.

PROBLEMS OF IDENTIFICATION OF CASES OF CHRONIC DISEASE

P. E. SARTWELL, M.D.

THE problem of diagnosis and classification arises whenever we try to study the epidemiology, or for that matter the clinical characteristics, of any disease, acute or chronic. The statistician and epidemiologist are concerned only with things that are countable. Bradford Hill quotes Bartlett as saying: "In so far as things, persons, are unique or ill-defined, statistics are meaningless . . . our arithmetic is useless unless we are counting the right things."

Recent years have seen a greatly improved appreciation of the inadequacies of diagnostic tests, and consequently of diagnoses, even in situations where it had been confidently assumed that errors were trivial. As an illustration, you are all familiar with the studies of the reproducibility of chest x-ray readings, so important in a screening program. This is a real advance. Much work, however, needs to be done in validating all sorts of commonplace medical measurements. There is still too great a tendency to look upon tests and diagnoses as reliable in an absolute sense.

Beginning with a report by Richard Cabot, a number of comparisons have been made between antemortem clinical diagnoses on hospitalized patients and the pathologist's final verdict. Most of these studies have been done in large teaching hospitals, with good laboratory facilities and readily available consultant services, and the diagnoses should therefore be better than those made in the patient's home or the physician's office, on the average. Yet sizable discrepancies have generally been found. One reason for the imperfect state of the science of diagnosis lies in the variability of symptoms, physical signs, and laboratory findings even in full-blown disease processes. Another may be termed the measurement error; that is, the resultant of all errors in making physical and laboratory tests,

and then interpreting their results. A third source of confusion is a result of the fact that most diseases manifest themselves in a continuous range of severity or extent going all the way from an unrecognizable or subclinical level, on to a maximal severity which may be incompatible with life. This range is sometimes referred to as the spectrum of clinical severity. In an individual the disease may progress with the passage of time all the way from the subclinical level on to death, or it may never go beyond some point part way along on the scale, and may then regress. In general, the nearer we are to the negative or subclinical end of the scale, the greater the difficulty is in making a diagnosis. In epidemiological or clinical studies it is necessary to decide at what point on the scale, and on what evidence, to classify a person as having the disease. The farther in the direction of increased severity or extent we draw this line, the smaller the error to be expected in our list of persons having the disease; in other words, the greater the specificity of our diagnoses. It must be remembered that the penalty for this increased specificity is usually a loss of sensitivity; that is, failure to list other true cases, less severe or less characteristic. In some types of study a high degree of specificity is to be desired, and in others, high sensitivity will be sought, but a middle ground is generally most satisfactory.

The question, how reliable are the diagnoses with which we have to work, must be prefaced with another—how is it possible to validate such diagnoses? This will, of course, depend on the disease. Only in rare instances do we have a single test that will do this for all cases, even all cases that are well out on the scale of severity. In diagnosing diabetes the sugar tolerance test is extremely helpful, but even here the borderline between negative and positive is not clear-cut. The demonstration of virulent tubercle bacilli by appropriate techniques proves the existence of tuberculosis, but significant tuberculous disease is present in many more persons than are sputum-positive; that is, the test is not a sensitive one.

The tissue pathologist can give us reliable diagnoses in many

instances, though he has perhaps been undeservedly immune from criticism up to date. His microscopic diagnoses may and should be tested as to their consistency and reproducibility, like those of other specialists. Assuming for the moment, however, that the pathologist is always right, it is still no solution to our problem to accept only diagnoses that have been pathologically established. The reason is that this involves a high degree of selection of the clinical material, even greater than limitation of a study to hospitalized cases. Suppose that we wish to study the geographic distribution of a series of cases of sarcoidosis; if we require a biopsy before including a case in the series, we shall first bias the types of cases included, because they must all have accessible lesions and second, communities having hospitals which for one or another reason do many biopsies will appear to have a high prevalence of sarcoid. For the vast majority of chronic diseases, then, there is no single pathognomonic symptom, physical sign, or laboratory test. We must depend upon a combination of findings which, taken in relation with the course of disease, is termed the "clinical picture," and which may, in the clinician's opinion, be more or less characteristic. How can we proceed to evaluate the likelihood of error in such diseases, and to reduce the number of errors?

One useful though limited approach, employed in the x-ray studies previously mentioned, is to test the reproducibility of our classification of cases, first by the same individual who made the initial classification, then by a second expert. In diseases where the classification depends wholly on examination of the patient, this is rather awkward to carry out and the examiner is likely to be influenced by his previous decision. He may sometimes be asked to review his written record of earlier findings (for instance, the history and neurological findings in certain neurological diseases) and render a second opinion. Then only the cases on whom there is diagnostic agreement may be selected for study. These techniques were employed by Westlund in a study to be reported at this meeting.

An attitude of skepticism on the part of the investigator is

always justified regardless of the reputation of the medical center in which the patients were diagnosed. An effort must be made to set down the important objective diagnostic criteria and find out what combinations of these are considered essential for a positive diagnosis. It is important, however, that these criteria should not be such as to force the cases into a mold formed by the preconceived opinions of the clinician. As a rather farfetched example of this, if the clinician has a preconceived belief that white females under 50 years of age never have osteoarthritis, and uses that belief in his classification of patients, the distribution of cases by age, sex, and race revealed in his series of osteoarthritics cannot be said to be characteristic of the disease.

Improvements in diagnosis are the direct responsibility of the clinician, to whom they are of the greatest interest and concern. The epidemiologist and statistician, however, need to understand the clinician's problems in order to work most effectively with the data which he supplies them. Frequently they in turn can aid the clinician in the process of analysing and interpreting his material.

To turn from the problems of classification in small, intensively studied series of cases to the analysis of mass data, the only point that will be mentioned here is that the investigator must be familiar with the nature of the raw data and the steps employed in processing it. It is not too much, for example, to ask him to examine at least a sample of death certificates for cases of a disease before making a study of trends of mortality in this disease based upon annual reports of mortality. He may find "jokers" of many kinds, some inherent in the certificates themselves, some introduced in the processing of the certificates. Thus Kurland and Moriyama found that about 18 per cent of death certificates coded and classified as "multiple sclerosis" actually showed "cerebral sclerosis" as the cause of death and that in nearly all these cases the physician meant "cerebral arteriosclerosis," not multiple sclerosis.

If a determined effort has been made to measure errors of

classification, the investigator may become so discouraged by their magnitude that he is tempted to abandon the study. At this point, however, it is important to avoid undue pessimism. No classification of illnesses or deaths can be perfect, better data frequently are unobtainable, yet important information is often available in crude data. Having recognized the imperfections of a classification, even a diagnostic error of 15 or 20 per cent oftentimes need not deter one from going on with a study. Important real characteristics of the material will not be obscured by errors of this size, although they will be less evident than in a "pure" sample of the disease, and while spurious characteristics may be introduced, we must take that chance. Certainly, to demand high specificity in diagnosis where that necessitates a marked bias in the selection of material is unwise.

PROBLEMS IN THE MEASUREMENT OF THE PROGRESSION AND REGRESSION OF CHRONIC DISEASE

ROBERT DYAR, M.D.

ILLNESS is a dynamic process, as is health. The subject of this discussion, problems in the measurement of the progression and regression of chronic disease, quite correctly assumes the existence of difficulties in identifying, measuring, and analyzing the perceptible events in the natural history of a chronic disease. Without laboring the definition of "chronic disease," I should like briefly to mention a few of the more conspicuous hazards to be faced, if we are to understand the behavior of some of these conditions.

The problems might be considered in three categories, which are not mutually exclusive: first, those associated with the disease itself; second, those related to the population at risk; and third, those inherent in the long interval of time necessary for observation.

Little is known of the epidemiology of the chronic diseases of public health significance today, and there are also many gaps in the clinical knowledge of these same diseases. So imperceptible may be the time of onset, that it is difficult to determine. The time of discovery or first recognition of disease may be known, but the disease may have progressed to a generally recognized far-advanced stage. Consequently, much of the natural history is missed or available only in retrospect. The inability to fix the time of onset compromises our information concerning duration. Any data on morbidity, incidence, and prevalence are subject to this limitation.

Generally acceptable criteria for early diagnosis of some of the chronic diseases, such as diabetes, and the hypertensive states are not yet available. Likewise, uniform and acceptable criteria for the objective measurement of progression or regression of such diseases are also lacking, or are subject to variation

in personal analysis or interpretation. Objective clinical milestones are badly needed in the course of chronic disease. They need not only to be identified and accepted, but also to be interpreted. For example, the distinctions among reinfection, relapse, and recurrence must be drawn.

The second group of problems, those associated with the selection of a universe of study, will be developed more fully elsewhere in this panel, but I should like merely to indicate that they too comprise hazards in the measurement of change. Change to be meaningful in the epidemiologic sense must be measured with respect to a definable base line. This base line may be established from a representative group of cases, the selection of which itself is difficult, or in a sample of the population. The validity of the observations of change is determined in part by the denominator, i.e., sample of population.

Our knowledge of the epidemiology of many chronic diseases is so meagre that we have little understanding of the influence of such factors as race, sex, and age. Any study of progression or regression must be related to such fundamental factors as these. The original sample must be of considerable size because of the manifold classifications required, if statistical reliability is to be obtained.

The third group of problems in measuring progression and regression of chronic disease are those associated with the time interval involved. The interval must be relatively prolonged, because of the very character of chronic disease and the gradual course of many of the recognized changes. In some instances the course of change must be measured not only in years, but in decades. Frost and others have developed the statistical techniques for expressing change in the cohort during such intervals. But as previously noted, date of onset is difficult to ascertain, and frequently the significance of changes which have occurred almost imperceptibly must be based on retrospective observation.

A study of change can be effectively accomplished by longitudinal studies, which do not require assumptions necessary in

a cross-sectional study. However, they are notoriously subject to unforeseen influences; serial observations sufficiently frequent enough to be complete are expensive; and the initial study group must be of considerable size if differential observations are to be significant and generalizations are to be valid. Further, in such studies the personal bias of different observers may introduce pertinent changes in observations over the period of time required for the study.

In summary, three groups of problems have been enumerated which have to do with the recognition of chronic disease, and its progression and regression. They are associated with the disease, with the case and the population under observation, and with the time interval of observation. There has been no attempt to develop these problems, or to suggest possible solutions.

PROBLEMS IN THE SELECTION OF A UNIVERSE FOR THE STUDY OF CHRONIC ILLNESS

FELIX E. MOORE

MANY of the statisticians present will at some time have been confronted with the following situation. The Chief calls you in and says, "Dr. Doe was telling me the other day that he has records on 1,000 cases of Roe's disease that he has seen over the past ten years. There's a gold mine of information there and I told him that I thought he ought to get some help to work it up statistically. I want you to drop around to see him one of these days." This not uncommon approach to medical research is what I like to call "A Universe in Search of a Problem."

There is an alternative approach—to start with a problem and search for a universe. I am sure that this group would agree that the specification of a problem for study must logically be antecedent to the specification of a universe. Indeed, if the problem is properly specified, the ideal universe will be implied. As a corollary, it might also be pointed out that there is no single universe for the study of chronic illness; there are as many universes (in the statistical sense) as there are problems.

Suppose we take, as an illustration of these points, the problem of prognosis after a coronary attack. Certainly it would be of considerable value to the physician at the present time to be able to state with a fair degree of assurance what is the proportion of persons who will, having had a first coronary attack, be alive after any specified period of time has elapsed. The first thing that is immediately obvious is that, if we want to study this problem, we must sample from a special universe, namely the universe of all persons who have had a coronary attack. Secondly, it is clear that this universe is unmanageable from the research standpoint. We must agree to narrow it with respect to both time and area. We might, therefore, re-state the prob-

lem as applying to white males in the United States at the present time.

At this point we see the necessity of making other compromises which are not, strictly speaking, statistical. If it is not feasible to study experience in the United States as a whole—and it clearly would not be in this problem—we should probably narrow our range of investigation to a more restricted geographical area—a city, or a small medical service area. But this narrowing of the universe from which we sample will of necessity be accompanied by restrictions on the generality of application of our conclusions. And so we have a process of give and take as our aspirations are adjusted to our capabilities.

Step by step, then, we approach a problem something like this:

1. Define the problem, i.e., state the question for which answer is required.
2. Describe the ideal universe from which a sample should be drawn to provide the answer.
3. Find that universe most closely approximating the ideal from which it is in fact practicable to sample.
4. State the restrictions which must be made on the generality of the answer which the practicable sample will provide.
5. Decide whether, in the face of these restrictions, the study is worth doing.

It is clear that these steps involve not only statistical problems—the whole research team (*vide* Gordon's discussion) will have to participate in their solution, since each member will have something to contribute. In passing, it may be worth noting that the art of statistics as well as the science will be involved, notably at steps 3 and 4, and this is perhaps the reason that there are statisticians specially labelled as "health" or "medical" statisticians.

I would like now to complete this discussion with a few illustrations, all well known to all of you, of the ways in which the problem determines our universe of study and the ways in which we cut our universe down to manageable size.

Expectation of Life. One of the elementary questions that a man can ask is how long he can expect to live. We don't, as statisticians, try to answer that for individuals, but we do undertake to answer it for classes of individuals. We accept, then, for research the question, "How long, on the average, will a class of persons of given age, sex, and race live?" The ideal universe in this case would be the completed lives of all persons in the given class now alive, but it is obvious that we can't wait until the last person dies to give an answer. In practice we go to the life table for our answer, which is to say that we accept as our universe a single year of experience. This considerably restricts our generalization, and we must now qualify our statement as to expectation by saying that it holds if mortality rates do not change. We have only an approximate answer to the original question, but we often find it useful.

Prevalence of a Disease. The question here is, "What proportion of the population is ill of a given disease in a specified interval of time?" The ideal universe is the total population of an area observed over the time interval. The practicable universe for study in this case will depend in large measure on the type of disease and the amount of information we require about it. If we are interested primarily in disease known to the individual, we may be willing to depend on the household survey using lay interviewers. In theory, we may not have to restrict our universe except to the extent that a certain group of non-cooperators will not be interviewed. In practice, we have apparently found it economically unfeasible since 1937 to survey anything like a sample of the United States, and so we must of necessity depend upon studies of more restricted areas such as the Baltimore Eastern Health District, or Hunterdon County, or San Jose. If we are interested in the prevalence of all stages of a disease, whether known to the afflicted individual or not, there must be some form of medical screening, and this will necessarily restrict our practicable universe geographically, and make the problem of non-response more important.

Etiological Factors in Disease. Because such chronic diseases

as arthritis, cancer, and arteriosclerotic heart disease have an insidious onset and long duration, the study of their etiology requires long-term longitudinal studies. Certain characteristics of these longitudinal studies make it almost mandatory to depart in at least two respects from the ideal universe which would be the entire adult population. First, the diagnostic procedures are difficult and require highly specialized medical and technical personnel. This makes it necessary that a team be assembled to work in a fairly limited geographical area. Second, the longitudinal study requires continued cooperation by a group of respondents who are willing to be re-examined over a period of years if we are not to depend solely on cause of death as the criterion for our study. Since it is not possible to get a completely representative sample of the population of any area to make themselves available for repeated examinations, we may find that our practicable universe has to be restricted to the point where there is serious question as to whether the data we can secure from it will answer the questions we have asked. This is a problem which has faced the National Heart Institute in its decision to carry out a twenty-year study of etiological factors in heart disease on a group of approximately 5,200 respondents in the town of Framingham, Massachusetts. While we can never reach generalizations which will be applicable with known error to the entire population of the United States, or Massachusetts, or even Framingham (because of non-cooperators), we feel that much that is valuable can be learned from an intensive study of this restricted group.

Prognosis. The study of prognosis after a coronary attack was mentioned in an earlier section where the desirability of geographical localization was discussed in general terms. In point of fact, prognosis in most diseases is dependent on treatment to such an extent that meaningful statements can be made only on the basis of known treatment. It is often desirable, on that account, to restrict the universe in studies of prognosis to persons with a comparable treatment regime, thus restricting the generality of statements that can be made, but causing

those which can be made to be more meaningful in the situations where they apply.

We have thus seen that the universe, which we actually select to sample from for any given study, will in practice be determined by the problem at hand and the practical considerations which lead us to depart from the ideal universe. The decision as to the extent to which departure from the ideal is allowable will be based on the state of our knowledge at any given moment and the amount that new knowledge is worth. In a state of ignorance, we are willing to accept data with many qualifications. As our knowledge increases, we require more precision and thus increasingly closer approximations to the ideal universe implicit in the problem. In our own field we have so little exact data about most problems that relatively crude approximations are still in order.

RESOURCES WHICH CAN BE TAPPED FOR LONG-RANGE STUDIES OF CHRONIC DISEASE

HERBERT H. MARKS

THE problems of chronic disease have come to occupy such a dominant place in the public health picture today, that the formation of a Committee on Chronic Disease Statistics in the American Public Health Association fills a real need. There has been a rapid expansion of organizations in the field. Consequently it will be necessary to plan the work and functions of this Committee so that they will be properly coordinated with other existing activities in order to avoid unnecessary duplication of work. Nevertheless, this Committee should take a broad view of its functions and its interests, because to some degree it represents the American Public Health Association in this field and because the caliber and talents of people within our membership enable them to guide and stimulate, as well as to conduct useful research.

There are many areas of statistical investigation in chronic disease which should have our interest, but I shall discuss only three broad areas, namely, prevalence, incidence, and prognosis. Within each of these three there are certain major subdivisions to be considered. Thus with respect to prevalence we are interested not only in the amount, but also degree of disability in terms of working time lost or duration of disability. In like manner, investigation of prognosis in chronic disease covers such matters as morbidity rates in the cohort under study, rate of progression, working time lost, frequency of hospitalization, mortality, and other factors.

In each area there are a number of sources of information that can be tapped. Some already have been developed to a degree but others have scarcely been touched for various reasons. Some sources are useful in one or more aspects of the whole problem, whereas the value of others is restricted to a single aspect.

Most familiar to all of us, both as a source of information on

incidence and prevalence, are the morbidity surveys, essentially cross-sectional surveys covering a limited period of time. Prime examples of these are the early sickness studies by Dublin and Frankel in selected communities, the Massachusetts Chronic Disease Survey, and the National Health Survey. The mechanics of such surveys, and their virtues and limitations as sources of statistics of both acute and chronic disease are well documented.

More intensive studies of communities or groups have also been done with sufficient frequency to provide a valuable background of experience as well as information. For example, I would mention the studies of sickness in Hagerstown, the studies done in connection with the work of the Committee on the Costs of Medical Care and the studies in the Eastern Health District in Baltimore. Somewhat different in nature but also of some value are the records of current morbidity based on reports of illness in industrial plants which have been regularly collected and analyzed by Gafaer of the Public Health Service. These are less valuable from the point of view of chronic disease than the other sources already mentioned but cannot be disregarded in a consideration of the whole field. Similar in character are the reports regularly available on morbidity in the Armed Services, although they obviously relate to a highly selected group of relatively young men. Some information of this character may also be developed from various types of insurance plans—Blue Cross, Blue Shield, and group and individual accident and health insurance written by commercial insurance companies and other organizations. There may be difficulties in tapping these sources because of the way their records are kept. However, the Committee might well look into the matter of interesting some of these organizations to cooperate so that usable information can be obtained.

Certain other sources that yield statistical information on chronic disease for more or less limited sections of the population are the records of periodic health examinations, Selective Service examinations, and school health examinations.

All the sources thus far mentioned cover the gamut of diseases or impairments. There have been in addition special surveys of specific diseases based either on current reporting or intensive investigation over a short period. Among the most notable in this field are the studies of cancer incidence and prevalence by Dorn and his associates, the latest of which are now being published. Another good example is the recent report on the incidence and prevalence of multiple sclerosis based upon careful study in a few communities. In the field of diabetes there is the excellent study by Wilkerson and Krall based upon urine and blood examinations of almost the entire population of Oxford, Massachusetts. Other sources giving information for specific diseases but of varying and often dubious quality are the routine reporting procedures for tuberculosis and cancer, and the various case-finding campaigns, such as mass X-ray surveys for tuberculosis and the Diabetes Detection Drives sponsored by the American Diabetes Association.

Without going into detail, certain of these mechanisms can be developed and improved so that they can provide more adequate long-term information on incidence and prevalence of chronic disease. It is within the province of this Committee to encourage and assist efforts in this direction.

The areas in which long-range studies of chronic disease have been most deficient are those which deal with the prognostic aspects of chronic disease. As already indicated, there are abundant sources but there is much to be done in the way of developing them and in devising or improving procedures so that this line of investigation will be most productive. At the head of the list of potentially useful sources, I would put the various types of comprehensive medical care plans, such as those provided by the Health Insurance Plan of Greater New York, because these records can provide valuable and detailed information on many different aspects of chronic disease, including factors influencing prognosis. The extensive investigations now being made of this experience will, I hope, be set up on a continuing basis and expanded so that the full potentialities of

these records may be realized. It should be realized, however, that these medical care plans are not research projects and that methods and resources have to be developed to make such investigations possible. Medical care plans are rapidly being extended under medical society and private life insurance company auspices. There are a few provided by industrial organizations, such as the Kaiser companies and the Endicott-Johnson Corporation, the shoe manufacturer. These, too, can eventually be developed as sources for data, but again it may have to be done by means of a cooperative research enterprise, independently organized and financed.

Another potential source for long-range studies of chronic disease consists of those industrial and governmental employee groups which have available a permanent medical service of good quality. I include, here, not only the large industrial and business concerns but also the Armed Services and any other group of governmental employees who have more or less continuous medical supervision. Most valuable for the purpose are those industries and groups in which turnover is least so that to a reasonable degree the population under observation is either stable or relatively homogeneous. Already there have been a limited number of studies covering specific conditions based upon records of this type. I cite, for example, various studies of cardiovascular diseases among army officers, of tuberculosis and hypertension among the personnel of the Metropolitan Life Insurance Company, and of tuberculosis at the Eastman Kodak Company, but the potential of this source has been scarcely touched. Much can be done if we get the cooperation of the physicians in charge of medical services in industries and government.

The records of the Veterans Administration constitute a source of prime value which has only begun to be used. Fortunately, the Committee on Veterans Medical Problems, Division of Medical Sciences of the National Research Council, is interested in developing various follow-up studies, the cohorts for which are derived from medical records of servicemen in

World War II. Much of the follow-up data are available from VA records. It can readily be seen too that for many conditions, and notably in the field of mental disease, the medical records of the Veterans Administration afford a major reservoir of large-scale studies of prognosis.

Homes for the aged which have good medical services constitute another promising source of continuing long-range studies of chronic disease, with which to my knowledge, relatively little has been done. This Committee should investigate the potentialities of this source and suggest ways in which methods and resources can be developed to exploit it.

Even the case records of diseases reported to health departments may in some instances be a basis for follow-up studies. An excellent example is Downes' study some years ago on the mortality among persons with active pulmonary tuberculosis, which was based upon the records of the Bureau of Tuberculosis of the Cattaraugus County Department of Health. Studies of this kind have the merit of including non-hospitalized as well as the hospitalized cases.

Another source consists of the records of life insurance companies on persons granted permanent disability benefits. They represent a rather rigidly selected group but the material is excellent and accessible and the findings, if properly interpreted, provide usable information. There is the advantage, too, that the status of the cases is readily ascertainable by reason of the continuing benefits paid. To my knowledge, there have been only a few studies based upon such records.

By far the most systematic and productive set of investigations based on life insurance records which give some information on prognosis of chronic diseases from the mortality standpoint are the various medico-actuarial studies. These have a long history in this country, going back as far as the beginning of the century, with the so-called Specialized Mortality Investigation. Since that time, there have been a number of elaborate investigations, the results of which have been published. These are the Medico-Actuarial Mortality Investigations, the Medical

Impairment Study—1929, the Medical Impairment Studies of 1936 and 1938, and the Blood Pressure Reports of 1925 and 1939. Another comprehensive study of this kind is well on its way to completion. In addition, the Transactions of the Association of Life Insurance Medical Directors and the actuarial journals contain reports of individual studies.

In a limited way and for a restricted group of impairments, principally the orthopedic conditions, workmen's compensation records may serve as a basis for studies of prognosis.

I have purposely put at the end what is probably the major source for long-range studies of prognosis consisting of the records of hospitals and of physicians with large practices in a specialty. This category includes records of the large tuberculosis and mental disease hospitals most of which are run by States and municipalities. While studies based upon these records have been made, they have been relatively few in number, considering the abundance and variety of the material available. Perhaps the best and most consistent use of such records has been made by Berkson and his associates of the Mayo Clinic. They have set a high standard of work too few others have followed.

There are many technical, administrative, and other problems which will have to be tackled and solved in the various phases of statistical studies of chronic disease. Suitable yardsticks have to be set up and properly defined. The assembly and interpretation of data call for a number of skills. This Committee can be helpful in all these aspects of the problem well as in stimulating studies and guiding them to a successful conclusion.

LONG RANGE STUDIES OF MENTAL HOSPITAL PATIENTS, AN IMPORTANT AREA FOR RESEARCH IN CHRONIC DISEASE

MORTON KRAMER

THE resource that I should like to discuss is the mental hospital. Since mental hospitals are not usually operated by the department of health and the admission and follow-up of discharged mental hospital patients is usually not a function of the health department, I will spend a few minutes describing the characteristics of the populations of these institutions. This discussion, I am sure, will show that the hospitalized mentally ill constitute a major chronic disease problem, and merit a comprehensive research effort.

In the United States there are 207 State, 50 county and city, 225 private hospitals for mental disease as well as the 34 V.A. neuro-psychiatric hospitals. The persons admitted to these hospitals are those with the more serious mental diseases, primarily the psychoses. They constitute a major illness problem for the nation because of their large numbers and the amount of care they require. The cost of their hospital care is prodigious. Combined, these hospitals spend more than \$500,000,000 annually for maintenance and care of patients.

Mental hospitals serve a dual function. Their primary functions is treatment and cure. If treatment fails the hospital acquires the function of a domicile for the chronic patient. Emphasis is usually placed on the intensive treatment of newly admitted patients since they represent the most hopeful cases. However, an increasing amount of attention is being paid to the chronic patient and it has been shown that intensive treatment of this group can also accomplish considerable. The chief stumbling block to intensive treatment for all types of patients is the extreme shortage of medical and nursing personnel in these institutions.

As of June 30, 1950, there were 577,000 patients or 3.8 per

Table 1. Resident patients at end of year in hospitals for the prolonged care of psychiatric patients, by type of control of hospital, and rates per 100,000 population: United States, 1941-1950.

YEAR	RESIDENT PATIENTS AT END OF YEAR					PERCENT OF TOTAL ¹				RATE ²	
	Total	State Hospitals	Veterans' Hospitals ³	County and City Hospitals	Private Hospitals	State Hospitals	Veterans' Hospitals	County and City Hospitals	Private Hospitals	Total	State Hospitals
1950	577,246	489,930	51,553	21,687	14,076	84.9	8.9	3.8	2.4	384.3	326.2
1949	564,160	478,003	52,380	19,859	13,918	84.7	9.3	3.5	2.5	382.5	324.0
1948	554,454	469,500	52,619	19,240	13,095	84.7	9.5	3.5	2.4	381.6	323.1
1947	540,987	452,464	52,505	23,643	12,375	83.6	9.7	4.4	2.3	379.2	317.2
1946	529,247	445,561	48,235	23,150	12,301	84.2	9.1	4.4	2.3	382.4	321.9
1945	518,018	438,864	42,204	23,850	13,100	84.7	8.1	4.6	2.5	371.1	344.3
1944	506,346	434,209	38,623	21,259	12,255	85.8	7.6	4.2	2.4	366.7	343.2
1943	500,564	430,958	35,953	21,297	12,356	86.1	7.2	4.3	2.5	366.7	338.2
1942	497,938	432,550	32,348	21,256	11,784	86.9	6.5	4.3	2.4	369.8	330.5
1941	490,506	417,315	30,443	31,812	10,936	85.1	6.2	6.5	2.2	368.2	317.2

¹ Per cents may not add to 100 because of rounding.

² Number of resident patients per 100,000 of the estimated population as of July 1 of the specified year. Base for total rate, years 1941-1945, is total population. Base for all other rates is civilian population.

³ Veterans hospital data for the period 1941 through 1945 referred primarily to patients in VA neuropsychiatric hospitals. In 1946 and 1947, the data included patients in all types of VA hospitals and in other Federal hospitals. In 1948 through 1950, coverage was reduced somewhat to eliminate duplicate counting by excluding VA patients in "other Federal hospitals." The bulk of these patients were in St. Elizabeths Hospital, Washington, D.C., and are therefore included in data for state hospitals.

⁴ Excludes patients in Iowa county homes. Also one hospital was transferred from city to State auspices in 1948.

1,000 population resident in all hospitals for the prolonged care of the mentally ill in the United States (Table 1). In addition there were 94,000 patients on extra-mural care. These patients, although not resident in the hospital, are still under supervision of the hospital.

In a single year the movement of patients in and out of these hospitals is considerable. For example, as of July 1, 1949, there were 656,000 patients on the books and in the following twelve months there were 263,000 admissions, 188,000 discharges, and 47,000 deaths. Thus there were over 900,000 patients under the care and supervision of mental hospitals during that year. This is about equal to the combined populations of the states of New Hampshire and Vermont.

The characteristics of patients admitted for the first time to long-term hospitals, especially to the state mental hospitals, are well known. The first admission rate to the state hospitals rises from a low of 22 per 100,000 for persons under 15 years of age to 78 at 30-34 years, levels off between 80 and 90 for persons 35 to 59 years, rises to 100 at ages 60-64 years, and climbs rapidly to a high of 278 at ages 70 and over (Figure 1).

These rates also give us information about age differences in first admissions for different types of disorders. For example, in the age range 15-44 years, schizophrenia and manic-depressive psychoses predominate. During the next decade of life the involutional psychoses, general paresis, and alcoholic psychoses attain considerable importance. In the sixties, psychoses with cerebral arteriosclerosis and senile psychoses assume prominence, and these mental diseases of the senium continue to rise in frequency until the end of the life span.

About 85 per cent of the resident patients are in the state mental hospitals. One quarter of these have been hospitalized for more than sixteen years, one-half for more than eight years, and three-quarters for more than two and a half years. Although admissions of senile cases have increased greatly in the last decade, the resident population of most mental hospitals consists largely of a slowly accumulated residue of schizo-

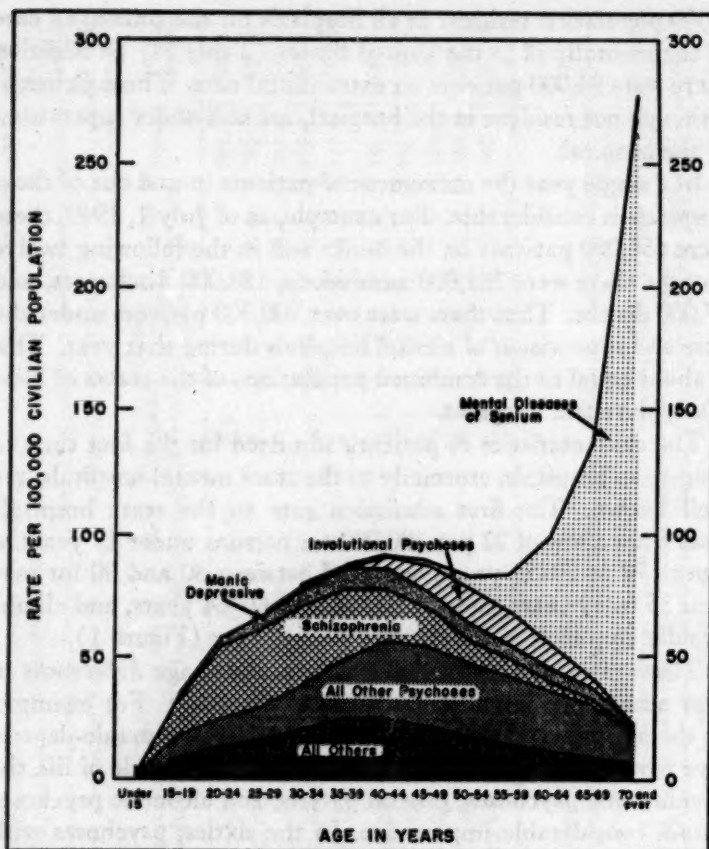


Fig. 1. First admission rates for selected diagnoses, by age, to state hospitals for mental disease, United States, 1949.

phrenic patients who are admitted during youth or early maturity and stay, in many cases, for the rest of their lives. The turnover of senile cases is very rapid because of their high death rate. These facts are illustrated in Tables 2 and 3 which show the percentage distribution by selected diagnoses and duration of hospitalization for patients resident in mental hospital systems of seven states at the end of 1950. The median duration

of hospitalization for schizophrenics—who constitute 47 per cent of the resident population and about 20 per cent of first admissions—was 10.5 years while that for patients with mental diseases of the senium—who constitute 11 per cent of the resident population and 27 per cent of first admissions—was 2.4 years.

There is an extensive literature on the characteristics of admissions to long-term hospitals, such as the studies of Malzburg (1) and Dayton (2). There have also been a series of ecological studies on psychoses in which admission rates to mental hospitals have been studied in relation to various socioeconomic factors. The best known of these is the study of Faris and Dunham (3) on hospitalized mental disorders in the Chicago area.

However, these studies have only scratched the surface. Much more remains to be done. I shall mention two areas in

Table 2. Per cent distribution of length of stay of all resident patients at end of year in state hospitals for mental disorder, by mental disorder, selected states,¹ 1950.

MENTAL DISORDER	TOTAL RESIDENT PATIENTS	TOTAL	PER CENT DISTRIBUTION OF LENGTH OF STAY (IN YEARS)					MEDIAN (in Yrs.)	MEAN (in Yrs.)
			Under 1	1-4	5-9	10-14	15 & Over		
TOTAL	128,982	100.0	14.2	25.5	17.5	14.4	28.4	7.9	11.1
All Psychoses	120,584	100.0	13.0	25.7	17.7	14.7	29.0	8.2	11.3
Syphilitic	9,109	100.0	10.1	29.0	24.5	18.6	17.8	7.2	9.2
Alcoholic	3,279	100.0	21.3	28.3	16.6	11.6	22.1	5.1	9.2
Mental Diseases of the Senium	14,249	100.0	26.9	48.4	14.7	6.3	3.8	2.4	4.1
Involutional	3,720	100.0	22.4	30.1	21.3	13.9	12.3	4.5	7.1
Manic-Depressive	10,574	100.0	11.1	17.8	16.5	15.2	39.4	11.5	13.9
Schizophrenic	61,201	100.0	10.0	21.5	17.1	15.8	35.6	10.5	13.1
With Mental Deficiency	6,770	100.0	7.0	20.0	18.4	17.2	37.4	11.3	13.6
Other, Undiagnosed and Unknown	11,682	100.0	14.1	25.6	18.6	14.9	26.8	7.8	10.7
Psychoneurosis	1,345	100.0	33.7	23.5	14.0	11.5	17.3	3.5	7.3
All Other Mental Disorders	7,053	100.0	30.7	22.7	14.7	10.9	21.0	4.2	8.4
Epilepsy	288	100.0	18.7	29.9	18.7	11.5	21.2	5.4	8.8
Mental Deficiency	3,472	100.0	7.8	21.2	19.6	16.6	34.9	10.4	13.0
Alcoholism	1,598	100.0	69.7	18.5	3.7	2.9	5.2	0.3	2.5
Other and Unclassified	1,695	100.0	42.8	28.7	14.2	6.7	7.7	1.8	4.7

¹ Data available from California, Louisiana, Michigan, Nebraska, Ohio, Pennsylvania, and Virginia. (Ohio does not include receiving hospitals).

which additional studies are needed. The first has to do with admission rates to mental hospitals. The second is concerned with longitudinal studies of patients to extend our knowledge as to what happens to them during their hospitalization and following their discharge back to the community.

1. STUDIES OF ADMISSION RATES

As our mental health programs develop and, hopefully, as research turns up methods for preventing and controlling mental disorders, indices will be needed to determine whether the incidence, prevalence, and course of specific mental disorders has been altered. First admission rates, long regarded as an incidence index for the psychoses, have been used to answer questions on whether there has been an increase or decrease in the incidence of specific disorders. Such studies, however, no matter how carefully done, suffer from the limitation

Table 3. Per cent distribution of all resident patients at end of year in state hospitals for mental disorder, by mental disorder and length of stay, selected states,¹ 1950.

MENTAL DISORDER	PER CENT DISTRIBUTION BY LENGTH OF STAY (IN YEARS)					
	Total Resident Patients	Under 1	1-4	5-9	10-14	15 & Over
TOTAL RESIDENT PATIENTS	128,982	18,305	32,875	22,519	18,519	36,690
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
All Psychoses	93.5	85.7	94.2	94.6	95.0	95.3
Syphilitic	7.1	5.0	8.0	9.9	9.1	4.4
Alcoholic	2.5	3.8	2.8	2.4	2.0	2.0
With Mental Diseases of the Senium	11.0	20.9	21.0	9.3	4.8	1.5
Involuntional	2.9	4.6	3.4	3.5	2.8	1.2
Manic-Depressive	8.2	6.4	5.7	7.7	8.7	11.4
Schizophrenic	47.4	33.4	40.0	46.4	52.0	59.4
With Mental Deficiency	5.2	2.6	4.1	5.5	6.3	6.9
Other, Undiagnosed and Unknown	9.1	9.0	9.1	9.7	9.4	8.5
Psychoneurosis	1.0	2.5	1.0	0.8	0.8	0.6
All Other Mental Disorders	5.5	11.8	4.9	4.6	4.1	4.0
Epilepsy	0.2	0.3	0.3	0.2	0.2	0.2
Mental Deficiency	2.7	1.5	2.2	3.0	3.1	3.3
Alcoholism	1.2	6.1	0.9	0.3	0.3	0.2
Other and Unclassified	1.3	4.0	1.5	1.1	0.6	0.4

¹ California, Louisiana, Michigan, Nebraska, Ohio, Pennsylvania, Virginia. (Ohio does not include receiving hospitals).

that the relationship existing between the number of persons hospitalized for a given disorder and the number of persons in the population with the same disorder who never reach a mental hospital is not known. Hospitalization rates are a resultant of the incidence of mental disorder and a series of factors that determine the number of persons who are eventually admitted to mental hospitals, such as: availability of mental hospital beds, availability and usage of other community resources for diagnosis and treatment of mental disorder (for example, general hospitals with psychiatric treatment services, psychiatric clinics and private psychiatrists), and public attitudes toward hospitalization. Thus, to understand more fully the distribution and course of mental illness in the population it is necessary to study hospitalization rates in relation to these factors. The solution to this problem is difficult, since it is dependent primarily upon development of practical case finding methods and standardized diagnostic procedures for detecting various mental diseases in the general population.

A project in this category is in progress in Syracuse, New York under the direction of Dr. Ernest M. Gruenberg of the New York State Mental Health Commission (4). This study deals specifically with psychoses associated with the aging process. These disorders are a serious problem for the mental hospitals, since the rates of admission have been increasing continuously over the years until now they constitute close to 30 per cent of first admissions. A major objective of the Syracuse project is development of case-finding methods for detecting unhospitalized persons with senile psychoses, and relating this number of cases to the number of cases actually committed. Relationships between the hospitalized and nonhospitalized senile cases will be studied according to various social and economic factors. A further step will be the development of clinical and preventive services in the community to learn what effect adequate services can have on reducing the incidence of mental illness among the older residents. The starting point for this study is the records of the admissions of residents of

Onondaga County to New York State civil and licensed mental hospitals for the period 1935-1944.

Additional studies of this type are needed, taking as their starting point other major mental disorders.

II. FOLLOW-UP STUDIES ON COHORTS OF ADMISSIONS TO AND DISCHARGES FROM MENTAL HOSPITALS

The concept of the mental hospital merely as a place of custody is no longer acceptable. To make these hospitals effective in their modern role, we must learn more about the patient, what happens to him in the hospital, and what happens to him upon his return to the community.

Mental hospital populations constitute an ideal group to which to apply life-table methods for describing their hospital experience. They consist of large groups of patients hospitalized for periods of time varying from a few days to many years. Their dates of admission to and separation from the hospital (either alive or dead) are known along with other data that are routinely reported such as sex, race, birth date, diagnosis, types of therapy. Despite the availability of these kinds of data, there have been very few studies designed to answer such questions as: Of patients admitted in a given year, what proportion remain in the hospital, are on convalescent care, discharged, or dead within six months, one, two or three years following admission? How are discharge and death rates related to diagnosis, sex, race, age at admission, therapy, and other relevant factors?

To illustrate how useful the cohort method of analysis is in determining what has been happening to patients in mental hospitals over a long period of time, an attempt was made to answer the question: "What is the current experience of patients during the first year following admission in terms of the per cent remaining in the hospital, out of the hospital, or dead, within the twelve-month period following their admission? How does the current experience compare with that of some earlier period?"

The mental hospital systems of seven states were asked to follow each patient admitted for the first time in 1948 for a full twelve-month period and to determine at the end of that time how many, by diagnosis, were still in the hospital, out of the hospital, or dead. "Out of the hospital" was defined as release to convalescent care or direct discharge, whichever came first. A similar set of data were found for patients admitted for the first time to New York State civil hospital system in 1914. It is believed that these data provide a reliable base line for comparison because of the outstanding quality of care the New York State hospitals have always provided. Table 4 compares the combined experience for seven states with that of New York State in 1914. It is realized that such comparisons are rather hazardous to make, especially when rates are unadjusted for age, sex, comparability of diagnoses, and many other factors. Unfortunately more refined statistical data are unavailable so that it was not even possible to compare even one state in this series with itself over a long period of time. Nevertheless it is felt that this particular illustration is worthwhile to indicate the importance of life-table methods in the study of mental hospital populations.

The data in Table 4 *suggest* that there have been important changes in the hospital experience of different types of mentally ill patients during their first year of hospitalization. To name only a few, the proportion of schizophrenic patients out of the hospital within twelve months is now 56 per cent as compared to 33 per cent in 1914. The proportion of involutional psychotics out of the hospital has increased from 35 per cent to 70 per cent and there has been a striking decrease in death rate from about 22.5 per cent to 4 per cent. On the other hand, many more patients with mental diseases of the senium (42 per cent as against 27 per cent) are in the hospital at the end of the first year, a result of the striking decrease in mortality rate (from 56 per cent to 42 per cent). These findings are all in accord with the experience of most mental hospital administrators.

Table 4. Comparison of patient years¹ of care needed within first year of admission, by selected diagnosis in 1914² and in 1948³ and estimate of savings for first admissions to state hospitals, United States: 1948.

DIAGNOSIS	PER CENT						PATIENT YEARS OF CARE PER 100 FIRST ADMISSIONS		FIRST ADMISSIONS TO ALL STATE HOSPITALS 1948	NET CHANGES ⁴ IN PATIENT YEARS OF CARE NEEDED WITHIN FIRST YEAR, STATE HOSPITALS, 1948	NET GAIN OR LOSS ⁵ IN COST OF MAINTENANCE DURING FIRST YEAR
	Remain- ing in Hospital		On Trial Visit or Dis- charged		Died		NEEDED WITHIN FIRST YEAR FOLLOWING ADMISSION				
	1914	1948	1914	1948	1914	1948	1914	1948			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)			
									(10)	$11 = 9 \times 10/100$	$12 = 11 \times \$659$
Schizophrenia	65.5	41.4	33.0	56.3	1.5	2.3	82.8	70.7	12.1	19,429	\$1,549,548.72
Involuntal Psychosis	42.5	25.5	35.0	70.4	22.5	4.1	71.3	62.8	8.5	4,220	236,429.93
Alcoholic Psychosis	27.0	24.9	67.0	70.4	6.0	4.7	63.5	62.5	1.0	4,650	30,649.55
Psychosis with Mental Deficiency	46.5	44.1	47.0	51.5	6.5	4.4	73.3	72.1	1.2	2,396	18,982.94
Manic-Depressive Psychosis	20.0	21.4	70.0	75.0	10.0	3.6	60.0	60.7	-0.7	5,662	26,101.55
Syphilitic Psychosis	35.0	42.6	23.8	36.8	41.2	20.6	67.5	71.3	-3.8	4,817	120,620.79
Mental Diseases of the Senium ⁶	26.5	41.8	18.0	16.5	55.5	41.7	63.3	70.9	-7.6	26,050	-1,304,945.57

¹ Patients discharged or dying were each credited with one-half patient year.

² Results based on data from New York civil State hospitals reported by H. Pollock, *MENTAL DISEASE AND SOCIAL WELFARE*, p. 156-169.

³ Results based on unpublished data submitted by Arkansas, California, Louisiana, Michigan, Nebraska, Ohio, and Virginia.

⁴ Where 1914 patient years needed exceed that of 1948, the result is positive; it is negative where 1948 patient years exceed that of 1914.

⁵ Based on capital maintenance cost in State hospitals in the United States in 1948 of \$639.11.

⁶ Includes psychosis with cerebral arteriosclerosis and senile psychosis.

This table emphasizes that a mental hospital provides care for people with a variety of disorders, each of which has its own prognosis. It also emphasizes the need for carefully planned studies of the life histories of mental hospital patients designed to show the effects of changes in patterns of treatment and care on eventual outcome.

In this connection, it is important also to follow up patients released from the hospital. On a nation-wide basis, we have only the crudest data about discharged patients. We need information such as the following:

Of patients who have been discharged, how many relapse and how soon? How are relapse rates related to diagnosis, sex, age on admission, length of hospitalization, therapy? Furthermore, we should like to know what social and environmental factors encountered by discharged patients are related to relapse or successful readjustment. Follow-up studies of patients discharged from tuberculosis sanatoria have proven very profitable in our understanding of that disease. There is no reason to suppose that such studies would be less valuable in the study of mental illness. Accurate follow-up data on discharged mental patients can serve as the basis for "discharge prediction" techniques, weighting significant factors in the patient's life history, diagnosis, clinical course in hospital, degree of improvement, and expected family and community environment. Furthermore, better understanding of relapse factors would greatly aid the development of rehabilitation programs for patients, while they are still in the hospital and later when they have returned to the community.

SUMMARY

The hospitalized mentally ill constitute a major health problem. Large numbers of persons are involved and their disability creates a serious economic problem for themselves, their families, and society. There is a vast amount of research that must be done on the etiology, epidemiology, and treatment of mental disorders. The results of such research should lead the way

to the development of more effective methods for prevention, control, treatment, and rehabilitation. Because of the complexity of the problems involved, many of the research projects must be interdisciplinary, combining the skills and knowledge of the psychiatrist, specialists in other branches of medicine, the psychologist, social scientist, the epidemiologist, and the statistician, to mention only a few. I have elaborated on only two types of studies that are needed, studies of admission rates and follow-up studies of cohorts of admissions and discharges. Others are needed, for example, studies related to the impact of mental illness on the family—i.e.—to the ways in which the roles, attitudes, and interpersonal relations within a family change following the hospitalization of one of its members, and to the frequency with which major illnesses, both mental and others, occur in the families of the mentally ill. But time does not permit me to elaborate further. However, I hope that this discussion has emphasized my belief that mental hospitals are an important resource to be tapped for long-range studies of chronic illness.

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ON THE ASSOCIATION BETWEEN HEALTH AND SOCIAL PROBLEMS IN THE POPULATION

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I. METHODS AND PRELIMINARY FINDINGS

INTRODUCTION

THE purpose of this first paper is to describe the statistical design and some findings of an investigation aimed at measuring the degree of association between (a) the health status of the families of a community, and (b) the number and kinds of their social and welfare problems that have required attention by community agencies. That a relationship exists between health and "socio-economic" status is inferred from the many studies which indicate that, (1) some illnesses are found more frequently, have longer duration of disability in one or the other social or economic segments of the population, (2) a large proportion of persons on public assistance has health problems.

The meaning of this relationship requires considerable clarification if it is to serve as a basis for community action. The fact that a large proportion of persons on public assistance manifests chronic diseases may be due to the general age incidence of the diseases and may have little bearing on the welfare status of the individuals. On the other hand, certain chronic diseases may be contributory factors to the development of a need for public assistance. Finally, the same factor, let us say a disabling injury, may have contributed to both the welfare status and disease condition. Community action or actions will differ considerably depending on which type of relationship occurs. Such actions will also differ depending on the intensity of this relationship. If only 1 per cent of blind per-

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sons require vocational guidance the problem is very unlike that in which 100 per cent of the blind need such guidance.

To clarify further the relationship between social and health characteristics, the specific factors which are involved in this relationship should be identified and their mode of operation determined. If poverty is associated with the higher incidence of a disease, the factor may be over-crowding, lack of medical care, lack of food, or some other condition.

In turn any one of these factors may contribute to diverse disease reactions in several ways. Over-crowding may affect the spread of tuberculosis in a family by increased person-to-person contact, lack of medical care may produce a similar effect through delay in diagnosis and care of the ill person. In sum, the association of poverty with tuberculosis acquires real meaning only when it becomes possible to specify the pertinent factors which affect the onset or the progress of the disease. A similar degree of specification is required to uncover the real significance of any association between any aspect of health and social characteristics of the population.

These considerations have guided us in planning a series of studies aimed at determining how often illnesses and certain economic or social characteristics are found together in a population; and how often, and under what conditions variations in specific aspects of health or disease precede or follow variations in specific aspects of economic or social status. The current investigation is part of that series, and is limited to the measurement of the association between health and those economic and social traits of the population which are of concern to the social-welfare agencies of Pittsburgh. In this and the following papers we shall report systematically the steps followed in the study. The complexity of the problem is well recognized and because of it, we present, whenever feasible, the full details of the several methods of approach employed and of the results obtained, of the gaps in our data and of the assumptions which underlie our conclusions. In this first paper, we shall describe the general design of the study, the collec-

tion of the data, a tentative method of classifying families according to health and social-welfare status; the variations in health and social-welfare status in relation to race-color, size of family, age, marital status, occupation and education of the head of the household; the crude association between health status of families and their social-welfare status.

STATISTICAL DESIGN

The first condition which must be met in the statistical design of this type of investigation is that the data be obtained from an unselected sample of the population of the community to which it is desired to generalize the findings. This is essential since the ultimate research goal is to arrive at an understanding of the factors which contribute to the occurrence of social-welfare as well as health problems. A design which calls for a sample made up of individuals who have been selected because they have either a health or social or welfare problem would not meet the logical requirements of the purpose of the study.

To pursue the point further, consider an approach in which one measures the health problems of recipients of various kinds of public assistance. The data may tell us what proportion of those on relief also have a disabling disease, but will not tell us what proportion of the population not on relief does (or does not) have this same disease. From the point of view of community action it is important to know whether or not families with individuals with this particular disabling disease are more likely to require assistance; and if so, whether the need is due to the nature of the illness or to factors interacting with health. An investigation which attempts to measure the precise nature of the overlap of health and welfare problems by studying only individuals with welfare problems is biased.

To avoid this bias and to achieve the objectives of our study, we have examined the health and social-welfare problems in a sample of the general population. Ideally, a scientifically designed sample provides data on sampling error and an estimate of the reliability of the inferences drawn from the sample

results. The control and measurement of the sampling error are not, however, the only conditions which must be considered in developing a study design. There are other sources of error, particularly those which are related to the accuracy of the individual measurements made. If the measurement procedures used are inaccurate or unrelated to the objective, a well-designed sample may actually turn out to be useless.

For this investigation, the measurements used were obtained from two general sources: (1) Measurements relating to health status were obtained through a house-to-house canvass. Experience has shown that a personal interview with a responsible member of the household is sufficiently accurate to give at least the magnitude or the amount of sickness even though it may be inaccurate for calculating the frequency of specific diseases. The technique, however, does not yield accurate or complete responses concerning the so-called "social diseases" e.g.: syphilis, mental disease. (2) Measurements of social-welfare status utilized an independent source of information. Since the objective of the study required data on marital discord, juvenile and adult delinquency, etc., we assumed from the beginning that a personal interview survey, while satisfactory for the measurement of health status, would be inefficient for the measurement of social-welfare status.

In sum, the plan of this study has involved: (1) the selection of a probability sample of the families in the community whose health and social-welfare problems have been investigated; (2) the measurement of the health characteristics of the selected families by means of personal interview with a responsible family member; (3) the determination of social-welfare problem characteristics of these families through an independent source.

The discussion to this point has attempted to bring out the major considerations which have led to the design of this study. There are, of course, many other decisions that must be made before a design can be considered complete. These refer in particular to the specific variables to be measured, the sample

size, etc. The essential approach used, however, was as outlined in the preceding paragraph. A detailed discussion of the actual procedure adopted follows.

COLLECTION OF DATA

The sample of families for this particular study was obtained as part of the general program of the department. Early in 1951, the Department of Biostatistics of the Graduate School of Public Health of the University of Pittsburgh had taken steps to establish an area for community health studies. The area chosen comprised the central portion of the then newly created Arsenal Health District of the Pittsburgh Health Department. A sample survey of the household population of the area, aimed at obtaining basic demographic data, information on recent illness, hospitalization, and accident experience, and on the utilization of private and public health services was made as the initial undertaking in a planned series of studies.² At the same time, the proposed plan for the project under discussion was drawn up. The advantage, in terms of a substantial savings in cost, of linking this proposed project with the initial morbidity survey for this area was clearly recognized. An effort was made, therefore, to insure that the survey design, data to be collected, etc., would also be adequate for accomplishing the objectives of the health and social problems project here described.

The survey was conducted during July, 1951, and covered some 3,000 households and 10,000 individuals in the study area. The population of this area is approximately 80,000. Suffice to mention here that probability sampling techniques were used in selecting the households for canvass. The actual sampling and field procedures used have already been reported elsewhere.³ The survey also included a one per cent sample of

² Ciocco, A.: Family Studies in Pittsburgh, Pennsylvania. In *RESEARCH IN PUBLIC HEALTH*, Proceedings of the 1951 Annual Conference of the Milbank Memorial Fund, 1952, pp. 248-254.

³ Horvitz, D. G.: Sampling and Field Procedures of the Pittsburgh Morbidity Survey. *Public Health Reports*, 67, No. 10, Oct. 1952, pp. 1003-1012.

the households located in the balance of Pittsburgh in order that estimates could be made of the differences between the study area and the City as a whole with respect to the characteristics measured.

The individuals and families studied with respect to health and social-welfare status are contained in the households selected from the Arsenal Study Area for this first survey (Survey I). A second survey (Survey II) in the planned series canvassed the same families in June, 1952. Data collected in both of these surveys are being used to measure the health status of these individuals and families.

To obtain data on social-welfare status, two steps were taken. First, each of the names obtained in Survey I was checked against the files of the Pittsburgh Social Service Exchange. The Exchange registers the cases opened by each of 105 member agencies. These agencies include those devoted to public assistance, family service, various health activities, miscellaneous special services, the courts and institutions for correction, etc. When the name was known to the Exchange, the second step was to check the files of the agency (or agencies) with whom the individual had had contact. This was done in order to obtain a description of the specific problems presented to the agency by the individual. Information was abstracted regarding date of initial contact, nature of the problem, and the disposition and/or referral made by the agency. Medical facts associated with the problem and verified by a physician were also recorded.

This study is limited, therefore, to the kinds of social-welfare problems which member agencies of the Social Service Exchange registered, and the completeness of the data depends on the completeness of the registration. It is our impression that few omissions have occurred when the problems concerned the larger agencies for these register all initial contacts routinely. Often several agencies will cooperate, according to their specific functions, in meeting a given problem. In these instances registration by only one of the agencies involved was

required for our purposes. Often, more than one, if not all, had registered the case. A source of error with respect to completeness of the data is the practice by some of the agencies of destroying the records of all cases that had been closed for a specified period of time. Fortunately, the time periods for which the records were kept, are of sufficient length so that little information was lost for this reason.

CLASSIFICATION OF HEALTH AND SOCIAL-WELFARE STATUS

In simple terms, the objectives of the investigation require the families selected for the study to be classified into one of the following groups: (a) Those with health problems but no social-welfare problems, (b) those with social-welfare problems but no health problems, (c) those presenting both health and social-welfare problems, and (d) those presenting neither health nor social-welfare problems.

With the families segregated in this way it is possible to answer such questions as: Do families with a large number of health problems also have a large number of social-welfare problems? Which ones? To what extent are those families which are known to the social agencies also known to the Health Department? How do the families having health and social-welfare problems differ from those having either type alone?

The segregation of the families into such groups requires definitions of health and of social-welfare status. Just as the method of collecting the data will have direct bearing on the accuracy and implications of the findings of any investigation, so will the definitions and classifications adopted for the analysis.

The method of approach to this investigation provides a simple classification of families according to social-welfare status; a classification based on the dichotomy: (1) known to social agencies, (2) not known to social agencies. However, the aims of the study require also a classification of the specific kinds of problems. For this purpose it has been necessary to

translate the descriptive accounts of the records into meaningful categories. Since the records, on the whole, followed the reporting system used by the Family Service Association of America, this system has served as a basis for a tentative classification. The actual criteria employed will be discussed later when data on problems will be presented in detail. For the present, it is sufficient to point out that the problems have been classified according to, (1) nature (e.g. family, mental health, behavior, employment, etc.); (2) requirements (e.g. financial aid, supervision of minor, etc.); (3) disposition (e.g. institutionalization, foster home placement, etc.)

The criteria adopted for classifying the problems do not exhaust all possible ways in which the social-welfare status of the families can be characterized. Other criteria can and will be employed as the analysis progresses. The important point to keep in mind is that the criteria adopted and the resulting classifications have an important bearing on the interpretations to be drawn from the findings.

Similar consideration must be given to the classification of families according to health status. In the first tentative classification we have sought to utilize the information obtained in both Survey I and Survey II regarding illness, physical impairment, hospitalization, and mortality. In this first phase of analysis we have classified families as having a health problem if one or more members (a) reported an illness during the month prior to the survey,⁴ (b) were hospitalized in the year prior to the survey,⁴ (c) reported an accident requiring hospitalization or physician's care in the year prior to the survey, (d) reported a chronic disease or physical impairment in the survey, (e) died in the year prior to the survey. These families have been further subdivided into (1) those reporting a health problem (exclusive of hospitalization) for Survey I or Survey II, but not both, (2) those reporting one or more persons hospitalized in Survey I or Survey II, but not both, and (3) those

⁴ Exclusive of pregnancy, delivery, or health examinations. INTERNATIONAL STATISTICAL CLASSIFICATIONS OF DISEASES, INJURIES AND CAUSES OF DEATH, designations Y00 to Y09 and 660.

reporting a health problem as defined above (a to e) for both Survey I and Survey II.

One further point may be made with respect to the classification issue and the conclusions to be drawn from the findings. As has been stated, we are dealing with certain types of social-welfare problems, since we have counted only those which came to the attention of an agency and were registered. We have no knowledge of those individuals with problems which were not brought to the attention of the social agencies, and, therefore, we cannot generalize our findings to cover all social-welfare problems.

MATERIAL

The initial sample selection (Survey I, July 1951) in the Arsenal Study Area yielded 2,954 households, i.e., dwelling units, to be surveyed. These contained 3,065 family units; a family unit being defined as (a) two or more persons related by blood, marriage, or adoption and occupying the same dwelling unit, (b) one person living alone in a dwelling unit or living with others but unrelated to them. Of these families 166 failed to cooperate.

Between Survey I and Survey II (June, 1952) 251 of the remaining 2,899 families moved from their dwellings; and in Survey II, 278 other families did not respond. Thus, we are left with 2,370 families about whom data on health status were obtained in both surveys. These are the families with which this study is concerned.

Information regarding contacts with agencies or institutions that are members of the Pittsburgh Social Service Exchange was requested for all the 3,065 family units, but it immediately became clear that we did not possess sufficient means of identifying the 166 families that did not respond in Survey I. These have been excluded from further consideration. Among the 2,899 remaining families, 1,072, or 37.0 per cent, were known to social agencies.

This percentage is slightly changed when we consider only

the 2,370 families described in this study. This is shown in Table 1 where a comparison is made between the families on whom data for both surveys are available and those families that either moved before Survey II or did not respond in this survey. A smaller percentage of the latter than the former group of families was known to social agencies. Although the differences are not statistically significant, it may still be that the families who move or do not respond experience slightly less contact with social agencies than families that do respond.

SOCIAL-WELFARE STATUS OF FAMILIES IN RELATION
TO CERTAIN CHARACTERISTICS

It is shown in Table 1 that 891 families of our sample are known to Pittsburgh social agencies. Among these 231 were still involved with these agencies as of July 1, 1950 (one year before Survey I), or became involved between June, 1950, and December, 1951. Of the remainder, the records definitely state for 504 families that the responsible agency had "closed the case" before July 1, 1950. The records are not so explicit about the other 156 families although there are indications that for these families also the "case was closed" by July 1, 1950.

Thus, among the total 2,370 families with which we are concerned 891 or 37.6 per cent are known to social agencies, but only 231 or 9.7 per cent are currently involved with these agencies.

It is generally assumed that families known to social agencies are not representative of the population of the community.

Table 1. Number of families in Arsenal Study Area and percentage known to Pittsburgh social agencies.

	TOTAL	KNOWN TO SOCIAL AGENCIES	
		Number	Per Cent
All Families ¹	2,899	1,072	37.0
Responded, Survey I and II	2,370	891	37.6
Moved after Survey I	251	89	35.5
Non-response, Survey II	278	92	33.1

¹ Exclusive of 166 families that did not respond in Survey I.

Since our data constitute a random sample of the households of the Arsenal Study Area, we are in a position to determine how the families known to social agencies differ from the general population with respect to certain characteristics on which we have obtained information. These characteristics include race-color, size of family, age, marital status, occupation, and education of head of household. We shall examine both the social-welfare status and health status of the families in relation to these characteristics, for the purpose of learning whether or not families with health problems differ from the general population to the same extent that do families known to social agencies.

1. *Race-Color.* There is a marked and significant difference between white and non-white in their contacts with social agencies. (Appendix Table 1-A). Of the latter families, 65 per cent were known to these agencies as contrasted to only 36 per cent of the white families. The difference is particularly striking in terms of proportion of families currently in contact with social agencies. Among the white families, only 8.6 per cent are currently in contact with social agencies while among the non-white families the percentage equals 34.2.

2. *Size of Family.* Proportionately more of the larger families are known to social agencies than the smaller ones. The data of Figure 1 and Appendix Table 1-B reveal a regular increase in the relative number of families known to social agencies as one moves from families of size 1, where we find 30 per cent, to families of size 7 or more, where there are 65 per cent known to social agencies. This last group of families also has the highest proportion (26 per cent) of those who are currently involved with social agencies, while families of size 3 has the lowest (6.5 per cent).

3. *Age of Head of Household.* We have found that age of head of household is correlated with the age of other members in the simple biological family. Such association is to be expected since there is high correlation between age of husband and wife, and the reproductive pattern by age is fairly stable. Use of the age of the head of the household appears to be ap-

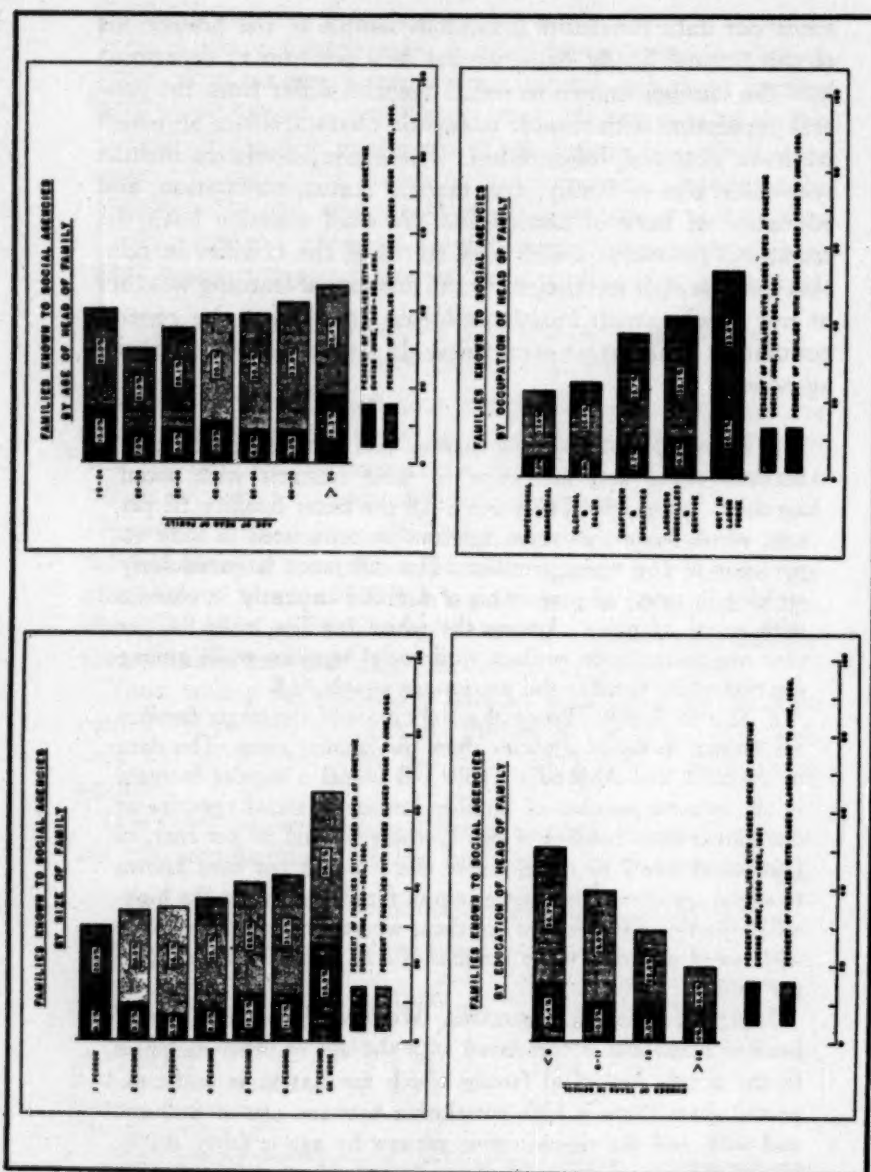


Fig. 1. Percentage of families known to Pittsburgh social agencies according to size of family, age, education, and occupation of head of household. Arsenal Study Area Sample, surveyed in July 1951, and June 1952.

propriate as an index of the age distribution of the individuals of a family. On the average, when the head of the household is young there are young children in the household, when he is old there are adults.

The proportion of families known to social agencies, exclusive of those families with heads 15-24 years of age, increases with increasing age of head of family. (Figure 1 and Appendix Table 1-C). Noticeable is the high proportion (18.3 per cent) with current social problems among the families whose head is 75 years and over.

4. *Marital Status, Occupation, and Education of Head of Household.* Families in which the head of the household is widowed, divorced or separated have relatively more contacts with the social agencies. It is seen in Appendix Table 1-D that 16 per cent of the families in which the head is widowed and 41 per cent in which he (or usually she) is divorced or separated are currently in contact with social agencies. These percentages are greater than those observed for the families in which the head is single (8.9 per cent) or married (7.2 per cent). This finding, although expected because of the nature of the activities of social agencies, still is very impressive in that it reveals clearly the significance of the family structure in creating the social-welfare problems with which the community has to deal.

The occupational class⁵ of the head of the household is reflected in the percentage of families known to social agencies. (Figure 1 and Appendix Table 1-E). Very few are known to these agencies when the head belongs to the professional and managerial, and clerical and sales classes. Instead, a substantial number are known when the head is either in the service and laborer class, or is not in the labor force. Noteworthy is the finding that over 20 per cent of the families whose head is not in the labor force are currently in contact with social agencies, while about 5 per cent of the families whose head is in the professional and manager class or in

⁵ The occupation classification of the Bureau of the Census was adopted for the Arsenal Study Area surveys cf. U. S. Bureau of the Census, 1950 CENSUS OF POPULATION: CLASSIFIED INDEX OF OCCUPATIONS AND INDUSTRIES. Washington, D. C.

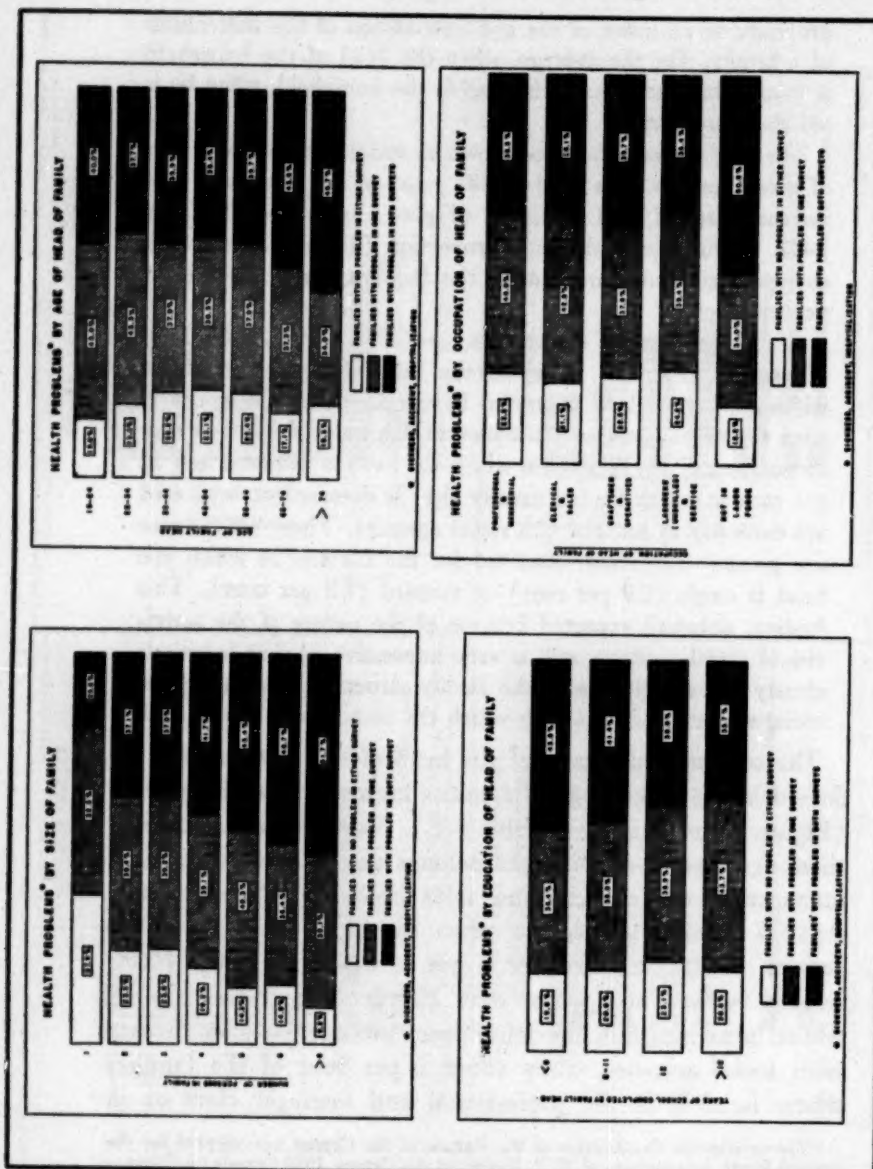


Fig. 2. Percentage of families with no health problem (see text) in either Survey, in one, or in both Surveys according to size of family, age, education, and occupation of head of household. Arsenal Study Area Sample surveyed in July 1951 and June 1952.

clerical and sales work are currently involved with these agencies.

The differences related to education are also remarkable as is seen in Figure 1 and Appendix Table 1-F. More than one half of the families whose heads did not complete elementary grades are known to agencies while this is true only of 20 per cent of those families in which the head had begun or completed college.

From our data we have a measure of the fact that families known to social agencies are found more often among non-whites, among large families, among those families in which the head is advanced in age, is widowed, or divorced, is not in the labor force, and has had little formal education.

There are two points to consider in connection with these observations. The first is the possibility that the several characteristics examined interact and, that the differences observed with respect to race-color, size of family, and the other characteristics are essentially due to the intimate association of the several characteristics among themselves. Analysis now in progress to elucidate this issue will be presented in another paper. The second point to consider is that these same characteristics may also be related to health status. If this is so, an association between health and social-welfare status would appear even though it would be entirely due to the fact that both health status and social-welfare status are related to these characteristics. The following data will clarify this point.

HEALTH STATUS OF FAMILIES IN RELATION TO CERTAIN CHARACTERISTICS

Among the 2,370 families, 22 per cent did not report a chronic disease or physical impairment, an illness in the month preceding each of the surveys, a hospitalization, severe accident, or death in the year preceding the surveys. These, as we have defined for the time being, have no health problem. In contrast, 40 per cent of the families had something to report in both surveys. The remaining 38 per cent had reported a hos-

pitalization or some illness in one or the other of the surveys. In view of the relationship between the family characteristics discussed above and social-welfare status, it is important to ascertain first of all whether these characteristics are related to health status as defined here. The pertinent data are given in Appendix Table 2 and summarized in Figure 2.

1. *Race-Color.* Very little difference is to be noted between the health status of whites and non-whites. Among the non-white families fewer have reported health problems but the sample of non-white families is small and the differences are not statistically significant.

2. *Size of Family.* It has been brought out in many studies that the larger families have more sickness than the smaller ones. The findings of this study point to the same results. The proportion of families with health problems in both surveys increases regularly with size of family, the proportion of families with no health problems decreases just as regularly with increasing size of family.

3. *Age of Head of Household.* The data of this study indicate that the largest proportion of families with no health problems are found when the head is in the middle-age group. In these families there are fewer of the very young and very old who are subject to high morbidity. The relationship of advancing age to illness incidence is seen by the higher proportion of families with health problems in both surveys when the head of the household is 65 years and over. The decrease in the frequency of hospitalization in one or the other of the surveys with increasing age of the head of the household is interesting as it probably reflects the lack of hospitalization insurance in these groups.

4. *Marital Status, Occupation, and Education of Head of Household.* The proportion of families with no health problems is greatest among the single and divorced or separated, while hospitalization is least. Age and other factors are undoubtedly operating to bring about these results. The same is true with reference to occupation of the head of the household. In this respect, the most striking finding is the high proportion of families in which the head is not in the labor force who reported

health problems in both surveys. This relationship may reflect many conditions among which age and disability are perhaps the most important. Similarly, the high hospitalization percentage among craftsmen and operators may in part be due to the greater availability of insurance to this group than to others.

An interesting finding appears when we examine the health status of families according to different levels of education of the head of the household. When the head has had a college education the proportion of families with health problems in both surveys is least; the proportion is highest when the head had not completed elementary school.

As is the case for social-welfare status, the health status of these families varies according to size and education, occupational class and age of the head of the household. Whites do not differ from non-whites in terms of health status as they do for social welfare status. Relatively fewer families in which the head is married are known to social agencies than those in which the head is single, widowed, or divorced, but relatively more of the former have health problems than the latter.

For both social-welfare status and health status, we find that proportionately more families have problems when the families are large or the head of the household is advanced in age or is not in the labor force, or has had little formal education. These findings point up more strongly the need to examine carefully the contribution of these characteristics to the presumed association between health and social-welfare status in the population. These findings indicate also the need to explore further the specific factors inherent in the relationship between size of family, and age, education, or marital status of the head of the household and health or social-welfare status.

HEALTH STATUS AND SOCIAL-WELFARE STATUS

A first crude measure of the relationship between health problems and social problems in this sample may be obtained by examining the frequency with which families in each of the four health status categories are known to the social agencies. The pertinent data are presented in Table 2. These data re-

veal that among families in which no sickness was reported in the month prior to the two surveys, and no accidents or hospitalization in the year prior to the survey, fewer are known to the social agencies than among those in which there was some sickness reported in both surveys. Among the former families, 28 per cent are known to social agencies and of the latter, 43 per cent. Among the former, 5 per cent are involved currently with social agencies, among the latter 13 per cent. The differences are not due to chance as is shown by a chi-square value of 45.8 calculated for the distribution in Table 2. On the basis of these findings the inference could be drawn that there is association between health status and social-welfare status as these are defined here.

We have repeatedly mentioned throughout this paper that additional considerations should guide us in the interpretation of this association. One such consideration is the possibility that this association merely reflects the fact that families with

Table 2. Distribution of families in Arsenal Study Area by health status (Survey I and Survey II) and social-welfare status.

HEALTH STATUS		SOCIAL-WELFARE STATUS					
		All Families	Not Known to Social Agencies	Known to Social Agencies			
				All	With Cases Open June 1950-Dec. 1951	With Cases Closed Before June 1950	Nature of Case Unknown
<i>No Health Problems Survey I and II</i>	Number	509	367	142	26	83	33
	Per Cent	100.0	72.0	28.0	5.3	16.3	6.4
<i>Health Problems without Hospitalisation, Survey I or II</i>	Number	620	404	216	54	122	40
	Per Cent	100.0	65.2	34.8	8.7	19.7	6.4
<i>Health Problems with Hospitalisation, Survey I or II</i>	Number	294	171	123	33	73	17
	Per Cent	100.0	58.2	41.8	11.2	24.8	5.8
<i>Health Problems Both Survey I and II</i>	Number	947	537	410	118	226	66
	Per Cent	100.0	56.7	43.3	12.5	23.8	7.0
<i>All Families</i>	Number	2,370	1479	891	231	504	156
	Per Cent	100.0	62.4	37.6	9.7	21.3	6.6

either health or social-welfare problems differ in the same manner from the general population. As a preliminary test of this possibility we have examined the distribution of families by health and by social-welfare status among the whites and the non-whites, among the small and large families, and among each of the other sub-groups of families into which our population can be separated according to the characteristics discussed in the preceding sections. For each of these distributions we have calculated the number of families expected to have neither health nor social-welfare problems, to have one or the other type of problem, or both, if families with health and with social-welfare problems were assorted at random. The chi-square test has been applied to the differences between observed and expected.

The results of this analysis are summarized in Table 3.⁶ Using the 5 per cent level of significance as indicative of association between health and social-welfare status, the chi-square values presented in Table 3 reveal that for the majority of these sub-groups the association between health and social-welfare status exists. However, there are some groups for which there is no indication of association. These are: size of family, four or more; head of household, (a) 65 years or more, (b) in clerical and sales occupational class, (c) not in labor force, (d) eight to eleven years of school, (e) more than twelve years of school.

These exceptions are interesting because we have found that among large families, among those in which the head of the household is 65 years or older, is not in the labor force, a larger proportion have health problems and have social-welfare problems. The lack of association observed here could indicate that certain aspects of size of family, of the age and occupation of the head of the household are related to the occurrence of both health and social welfare problems and this produces a spurious correlation between the two conditions when families are examined without due regard to these characteristics.

⁶ Data on the observed and expected distributions for each sub-group of families are available on request.

SUB-GROUPS OF FAMILIES	CHI-SQUARE (DEGREES OF FREEDOM = 2)	PROBABILITY OF A CHI-SQUARE AS LARGE OR LARGER WHEN THERE IS INDEPENDENCE
<i>A. Race-Color</i>		
White	31.6	< .01
Non-White	6.2	.05-.02
<i>B. Size of Family</i>		
1-3 Persons	28.9	< .01
4 or More Persons	4.3	.20-.10
<i>C. Age of Head of Household</i>		
Under 35 Years	6.7	.05-.02
35 to 64 Years	25.2	< .01
65 Years and Over	3.8	.20-.10
<i>D. Marital Status of Head of Household</i>		
Married	14.1	< .01
Widowed, Separated, Divorced, Single	30.1	< .01
<i>E. Occupation of Head of Household</i>		
Professional and Managerial	6.4	.05-.02
Clerical and Sales	4.2	.20-.10
Craftsman and Operatives	6.3	.05-.02
Service Workers and Laborers	10.4	< .01
Not in Labor Force	3.6	.20-.10
<i>F. Education of Head of Household</i>		
Less than 8 Years of School	13.5	< .01
8 to 11 Years of School	4.6	.10
12 Years of School	12.1	< .01
More than 12 Years of School	3.9	.20-.10

Table 3. Chi-square values for test of independence of health status and social-welfare status in specified sub-groups of families in the Arsenal Study Area.

These findings emphasize again the difficulties which would beset any attempt to interpret the association observed at this stage of the study. The fact that such association is not always present, and that it is not present in some of the groups that demonstrate a high prevalence of health and social-welfare problems, could mean that several kinds of factors may be operating to bring about the observed frequency with which

health problems and social-welfare problems are found together in the same families. We hope to throw more light on this question in a subsequent report.

SUMMARY

This is the first report of a study aimed at determining the degree and nature of association between ill health and problems of concern to social agencies in the community. The data on health have been obtained from two successive household surveys conducted nearly a year apart on a random sample of 3,000 families in the Arsenal Health District; the data on social-welfare problems have been abstracted from the records of the agencies reporting to the Social Service Exchange. A first tentative classification of these families according to health status and to social-welfare status has been described. The relationship of such characteristics as race, size of family, age, marital status, occupation and education of the head of the household and the health and social-welfare status have been examined.

Briefly, the data indicate with respect to social-welfare problems:

1. Approximately 38 per cent of the families are known to social agencies. Almost one-fourth of these, i.e., 9 per cent of all the families, have some current problem being considered by these agencies.

2. Relatively more families are known to the social agencies among those families that are non-white, are large, and in which the head is old, not in the labor force, is widowed or divorced, or has little formal education.

Analyses of the distribution of families according to health status as defined in this report reveals:

1. The percentage of families who have reported no health problems in the two surveys is 22, while that of families that reported some illnesses, hospitalization or accidents in both surveys is 40.

2. Among families in which the head of the household has

little formal education or is not in the labor force the proportion with health problems in both surveys is greater than in families with other characteristics. With increase in size of family there is decrease in the proportion of families with no health problems in either survey, and also there is increase in the percentages of families with reported illnesses, etc., in both surveys.

With reference to the association between health and social-welfare problems, it is found that among families with reported illnesses, accidental injuries and hospitalizations in both surveys 12 per cent have social-welfare problems currently in contrast to only 5 per cent among families with no reported illness, accident, or hospitalization in either survey. In the first group, 43 per cent of the families are known to social agencies, in the second only 28 per cent.

Comparison of families having health problems in both surveys with families reporting no health problems in either survey shows that the proportion known to social agencies is:

1. Significantly higher in the former than in the latter when we examine separately white families; non-white families; families with one to three persons; families in which the head of the household is (a) under 35 years of age, (b) 35 to 64 years of age, (c) married, (d) widowed, divorced, separated, or single, (e) in a professional or managerial class, (f) in craftsmen and operative class, (g) in services and laborer class, or has (h) less than 8 years of school, or (i) completed high school.

2. Not significantly different in families of four or more persons, and in families in which the head of the household is (a) 65 years and over, (b) in clerical and sales class, (c) not in the labor force, (d) eight to eleven years of school, or (e) has had more than twelve years in school.

Appendix Table 1. Distribution of families in Arsenal Study Area by certain characteristics and by social-welfare status.

CHARACTERISTICS			ALL FAMILIES	NOT KNOWN TO SOCIAL AGENCIES	KNOWN TO SOCIAL AGENCIES			
					All	With Cases Open June 1950-Dec. 1951	With Cases Closed Before June 1950	Nature of Case Unknown
TOTAL SAMPLE		Number	2,370	1479	891	231	504	156
		Per Cent	100.0	62.4	37.6	9.7	21.3	6.6
A. Race-Color	White	Number	2,256	1439	817	192	475	150
		Per Cent	100.0	63.8	36.2	8.6	21.0	6.6
	Non-White	Number	114	40	74	39	29	6
		Per Cent	100.0	35.1	64.9	34.2	25.4	5.3
B. Size of Family	1 Person	Number	216	151	65	20	33	12
		Per Cent	100.0	69.6	30.4	9.7	15.2	5.5
	2 Persons	Number	520	344	176	48	88	40
		Per Cent	100.0	66.2	33.8	9.2	16.9	7.7
	3 Persons	Number	551	360	191	36	121	34
		Per Cent	100.0	65.3	34.7	6.5	22.0	6.2
	4 Persons	Number	501	315	186	40	114	32
		Per Cent	100.0	62.9	37.1	8.0	22.7	6.4
	5 Persons	Number	308	180	128	38	66	24
		Per Cent	100.0	58.4	41.6	12.3	21.5	7.8
	6 Persons	Number	154	87	67	18	41	8
		Per Cent	100.0	56.5	43.5	11.7	26.6	5.2
	7 or More Persons	Number	120	42	78	31	41	6
		Per Cent	100.0	35.0	65.0	25.8	34.2	5.0
C. Age of Head of Household ^(a)	Less Than 34 Yrs.	Number	367	256	111	30	75	6
		Per Cent	100.0	69.8	30.2	8.2	20.4	1.6
	35-44 Yrs.	Number	564	366	198	51	116	31
		Per Cent	100.0	64.9	35.1	9.0	20.6	5.5
	45-54 Yrs.	Number	523	319	204	57	101	46
		Per Cent	100.0	61.2	38.8	10.9	19.1	8.8
	55-64 Yrs.	Number	482	294	188	41	111	36
		Per Cent	100.0	61.0	39.0	8.5	23.0	7.5
	65-74 Yrs.	Number	281	162	119	24	71	24
		Per Cent	100.0	57.7	42.3	8.5	25.3	8.5
	75 Yrs. and Over	Number	109	58	51	20	20	11
		Per Cent	100.0	53.2	46.8	18.3	18.3	10.1
D. Marital Status of Head of Household ^(b)	Married	Number	1,785	1164	621	129	380	112
		Per Cent	100.0	65.2	34.8	7.2	21.3	6.3
	Single	Number	168	123	45	15	16	14
		Per Cent	100.0	73.2	26.8	8.9	9.6	8.3
	Widowed	Number	337	169	168	54	89	25
		Per Cent	100.0	50.2	49.8	16.0	26.4	7.4
	Divorced or Separated	Number	78	22	56	32	19	5
		Per Cent	100.0	28.2	71.8	41.0	24.4	6.4

Appendix Table 1. (Continued.)

CHARACTERISTICS			ALL FAMILIES	NOT KNOWN TO SOCIAL AGENCIES	KNOWN TO SOCIAL AGENCIES			
					All	With Cases Open June 1950-Dec. 1951	With Cases Closed Before June 1950	Nature of Case Unknown
E. Occupation of Head of Household ^(a)	Professional & Managerial	Number Per Cent	340 100.0	264 77.6	76 22.4	17 5.0	51 15.0	8 2.4
	Clerical & Sales	Number Per Cent	299 100.0	225 75.3	74 24.7	13 4.3	41 13.7	20 6.7
	Craftsmen & Operatives	Number Per Cent	873 100.0	542 62.0	331 38.0	72 8.4	197 22.5	62 7.1
	Service & Laborers	Number Per Cent	442 100.0	255 57.7	187 42.3	45 10.2	106 24.0	36 8.1
	Not in Labor Force	Number Per Cent	382 100.0	176 46.1	206 53.9	77 20.2	101 26.4	28 7.3
	Less Than 8th Grade Completed	Number Per Cent	486 100.0	240 49.4	246 50.6	70 14.4	141 29.0	35 7.2
F. Education of Head of Household ^(a)	8-11th Grade Completed	Number Per Cent	965 100.0	584 60.5	381 39.5	101 10.5	212 22.0	68 7.0
	12th Grade Completed	Number Per Cent	416 100.0	294 70.7	122 29.3	27 6.5	66 15.9	29 6.9
	More Than 12th Grade Completed	Number Per Cent	272 100.0	219 80.5	53 19.5	11 4.0	34 12.5	8 3.0

(a) Excluding 44 families not reporting age of head of household.

(b) Excluding 2 families not reporting marital status of household.

(c) Excluding 34 families not reporting occupation of head of household.

(d) Excluding 231 families not reporting education of head of household.

Appendix Table 2. Distribution of families in Arsenal Study Area by certain characteristics and by health status.

CHARACTERISTICS		HEALTH STATUS			
		ALL FAMILIES	No Health Problems Survey I and II	Health Problems without Hospitalization Survey I or II	Health Problems with Hospitalization Survey I or II
TOTAL SAMPLE	No.	2370	509	620	294
	Per Cent	100.0	21.5	26.1	12.4
A. Race-Color	No.	2256	481	590	276
	Per Cent	100.0	21.4	26.1	12.2
Non-White	No.	114	28	30	18
	Per Cent	100.0	24.6	26.3	15.8
B. Size of Family	No.	216	82	58	12
	Per Cent	100.0	38.0	26.9	5.5
2 Persons	No.	520	122	151	54
	Per Cent	100.0	23.5	29.0	10.4
3 Persons	No.	551	131	145	71
	Per Cent	100.0	23.8	26.3	12.9
4 Persons	No.	501	96	122	74
	Per Cent	100.0	19.2	24.3	14.8
5 Persons	No.	308	44	81	43
	Per Cent	100.0	14.3	26.3	14.0
6 Persons	No.	154	23	32	24
	Per Cent	100.0	14.9	20.8	15.6
7 or More Persons	No.	120	11	31	16
	Per Cent	100.0	9.2	25.8	13.3
C. Age of Head of Household ^(a)	No.	367	69	102	57
	Per Cent	100.0	18.8	27.8	15.5
Less Than 34 Yrs.	No.	564	125	133	81
	Per Cent	100.0	22.1	23.6	14.4
35-44 Years	No.	523	121	141	60
	Per Cent	100.0	23.1	27.0	11.5
45-54 Years	No.	482	108	127	56
	Per Cent	100.0	22.4	26.4	11.6
55-64 Years	No.	281	48	70	35
	Per Cent	100.0	17.1	24.9	12.5
65-74 Years	No.	109	21	32	5
	Per Cent	100.0	19.3	29.3	4.6
75 Yrs. and Over	No.	100.0	19.3	29.3	4.6
	Per Cent	100.0	19.3	29.3	4.6

Appendix Table 2. (Continued.)

D. Marital Status of Head of House- hold ^(a)	Married	1785		356		469		231		729	
		No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
E. Occupation of Head of Household ^(a)	Single	No.	Per Cent	168	100.0	60	19.9	46	26.4	14	12.9
	Widowed	No.	Per Cent	337	100.0	69	35.7	88	27.4	42	8.3
	Divorced or Separated	No.	Per Cent	78	100.0	23	20.5	17	26.1	7	12.5
		No.	Per Cent	100.0	100.0	29.5	29.5	21.8	21.8	9.0	9.0
F. Education of Head of Household ^(a)	Professional & Managerial	No.	Per Cent	340	100.0	80	23.5	101	29.7	35	10.3
	Clerical & Sales	No.	Per Cent	299	100.0	63	21.1	90	30.1	38	12.7
	Craftsmen & Operatives	No.	Per Cent	873	100.0	196	22.5	202	23.1	128	14.7
	Service & Laborers	No.	Per Cent	442	100.0	107	24.2	122	27.6	52	11.8
	Not in Labor Force	No.	Per Cent	382	100.0	58	15.2	93	24.3	37	9.7
		No.	Per Cent	100.0	100.0	15.2	15.2	24.3	24.3	9.7	9.7
	Less Than 8th Grade Com- pleted	No.	Per Cent	486	100.0	96	19.8	121	24.9	56	11.5
	8-11th Grade Completed	No.	Per Cent	965	100.0	199	20.6	236	24.5	130	13.5
	12th Grade Completed	No.	Per Cent	416	100.0	96	23.1	111	26.7	51	12.3
	More Than 12th Grade Completed	No.	Per Cent	272	100.0	56	20.6	89	32.7	30	11.0

(a) Excluding 44 families not reporting on age of head of household.

(b) Excluding 2 families not reporting on marital status of head of household.

(c) Excluding 34 families not reporting on occupation of head of household.

(d) Excluding 231 families not reporting on education of head of household.

SOCIAL AND PSYCHOLOGICAL FACTORS AFFECTING FERTILITY

XX. THE USE, EFFECTIVENESS, AND ACCEPTABILITY OF METHODS OF FERTILITY CONTROL¹

CHARLES F. WESTOFF, LEE F. HERRERA, AND
P. K. WHELPTON

MANY observers of man's development through the ages have conceived his history as a series of trial and error attempts to control the external forces that affect him. In relatively recent times, this perspective has more and more emphasized the social and psychological, as well as the physical environment. An ever-increasing range of phenomena, heretofore accepted as "natural" processes not to be interfered with by man, have become subject to individual control. This process, which is familiar to the student of social change under the name of "secularization," has come to include even the control and determination of human reproduction—a subject which not too long ago was considered well outside the province of scientific inquiry. Nevertheless, it is a fact that human fertility is becoming increasingly a function of rational control, and that consequently the birth rates of many countries in Western civilization reflect in large measure the net result of a great number of conscious, deliberate choices between alternative courses of behavior.

This whole process of social change, which has been accelerated in this country in the last half century, has resulted in what is believed by many to be only a temporary pattern of large group differences in fertility. The strong inverse relation of fertility to such indices of socio-economic status as income, occupation, and education has been interpreted by

¹ This is the twentieth of a series of reports on a study conducted by the Committee on Social and Psychological Factors Affecting Fertility, sponsored by the Milbank Memorial Fund with grants from the Carnegie Corporation of New York. The Committee consists of Lowell J. Reed, Chairman; Daniel Katz; E. Lowell Kelly; Clyde V. Kiser; Frank Lorimer; Frank W. Notestein; Frederick Osborn; S. A. Switzer; Warren S. Thompson; and P. K. Whelpton.

most sociologists as a result of the uneven diffusion of birth control information through the various strata of society. It has been reasoned that as soon as this process of diffusion is complete the familiar inverse relationships will diminish substantially and may even be reversed. More precisely, the current theory as suggested by the evidence of the Indianapolis Study² and other research is that when the ratio of planned pregnancies to total pregnancies approaches unity, a *direct* relationship between socio-economic status and fertility will emerge; that is, couples will have the number of children they both desire and believe they can afford.³

If the theory of the unequal diffusion of birth control knowledge and practice is empirically valid, we should expect important class differences not only in the use of contraception *per se* but also in the relative effectiveness of the methods used. Furthermore, among those using the most effective methods we should probably further expect class differences in the proficiency of use. These and other basic questions, addressed both to a sample of the general population as well as to its class divisions, are examined in this analysis in the light of evidence collected in the Study of Social and Psychological Factors Affecting Fertility, known more briefly as the Indianapolis Study.

Other analyses of the Indianapolis Study data have explored the interrelations of many social and psychological variables with fertility-planning status. The classification system employed in this concept of "fertility-planning status"⁴

² See especially Kiser, Clyde V. and Whelpton, P. K.: Social and Psychological Factors Affecting Fertility. ix. Fertility Planning and Fertility Rates by Socio-Economic Status. The Milbank Memorial Fund *Quarterly*, April 1949, xxvii, No. 2, pp. 188-244 (Reprint pp. 359-414).

³ See Kiser, Clyde V. and Whelpton, P. K.: Social and Psychological Factors Affecting Fertility. xi. The Interrelation of Fertility, Fertility Planning, and Feeling of Economic Security. The Milbank Memorial Fund *Quarterly*, January, 1951, xxix, No. 1, pp. 41-122 (Reprint pp. 467-548).

For a more recent analysis of evidence pertinent to this trend cf. Kiser, Clyde V.: Fertility Trends and Differentials in the United States. *Journal of the American Statistical Association*, March, 1952, 47: pp. 37-48.

⁴ See Whelpton, P. K. and Kiser, Clyde V.: Social and Psychological Factors

(Continued on page 293)

attempts to measure the relative degrees of planning success, that is, the extent to which couples had planned successfully both the number and the spacing of the children they wanted. As such, the resultant categories reflect the combined influences of complex differences in motivation which govern the regularity of contraceptive practice, and the choice and use of methods which vary in their degree of effectiveness. The present analysis does not endeavor to refine this classification scheme or to analyze further the motivational factors involved in fertility planning but rather, in addition to the above-mentioned objectives, purports to measure the observed effectiveness of the various contraceptive methods actually used. Other relevant research questions that are raised and partially answered in this report are: What are the sources of first information for couples about methods of contraception? From whom do they obtain their "most satisfactory" information? Why do couples use certain methods rather than others? Why do they find certain methods unsatisfactory and change to other methods? Are the most effective methods also the most acceptable methods?

The basic question of the effect on fertility of contraception in general has already been explored to some extent in previous articles of this series.⁵ This entire subject of the effectiveness and acceptability of selected methods of contraception has also been probed at length in other studies.⁶ To some extent the generalizations of these latter studies are limited by the

Affecting Fertility. vi. The Planning of Fertility. The Milbank Memorial Fund *Quarterly*, January, 1947, xxv, No. 1, pp. 63-111 (Reprint pp. 209-257).

⁵ See Whelpton, P. K. and Kiser, Clyde V.: Social and Psychological Factors Affecting Fertility. viii. The Comparative Influence on Fertility of Contraception and Impairments of Fecundity. The Milbank Memorial Fund *Quarterly*, April, 1948, xxvi, No. 2, pp. 182-236 (Reprint pp. 303-357).

⁶ A few of the leading American studies in this field are those of Raymond Pearl, the results of which are summarized in his *THE NATURAL HISTORY OF POPULATION*. New York, Oxford University Press, 1939; Stix, Regine K. and Notestein, Frank W.: *CONTROLLED FERTILITY*. Baltimore, The Williams and Wilkins Company, 1940; and Beebe, Gilbert W.: *CONTRACEPTION AND FERTILITY IN THE SOUTHERN APPALACHIANS*. Baltimore, The Williams and Wilkins Company, 1942. For a basic bibliography on the subject, see Beebe, pp. 259-267. For a more specialized bibliography which concentrates more on the medical aspects of contraception see Dickinson, Robert L.: *CONTROL OF CONCEPTION*. Baltimore, The Williams and Wilkins Company, 1938 (Second Edition), pp. 353-370.

peculiarities of the populations to which they were restricted; for example, such admittedly unrepresentative groups as maternity patients and solicitors of aid from birth control clinics. To the growing literature in this field, the present analysis contributes an examination of the effectiveness and acceptability of many different methods of fertility control within a more "normal population."

DATA AND CLASSIFICATIONS

This analysis is based on the information supplied by 1,977 wives (the "inflated" sample) to detailed questions about their pregnancy and contraceptive histories ranging over a married period of 12 to 15 years. The various requirements that these couples had to meet for inclusion in the intensive interview study have been detailed in previous reports.⁸ Briefly, the sample was restricted to couples who were native white, Protestant, at least eighth grade graduates, married during 1927-1929, never previously married, residents of a large city most of the time since marriage, and with the husband under 40 and the wife under 30 at marriage.

Most of the previous articles in this series have analyzed various relationships in terms of numerous characteristics exhibited either by the couples or by the wives or husbands treated separately. Since the major part of the present analysis departs from this procedure and subdivides the experience of individual couples according to types of contraceptive and noncontraceptive *exposure*, and uses months or years rather than couples as discrete statistical units,⁹ it will be helpful at

⁸ For a detailed discussion of the sampling see Whelpton, P. K. and Kiser, Clyde V.: Social and Psychological Factors Affecting Fertility. v. The Sampling Plan, Selection, and Representativeness of Couples in the Inflated Sample. *The Milbank Memorial Fund Quarterly*, January, 1946, xxiv, No. 1, pp. 49-93 (Reprint pp. 163-207).

⁹ For a complete description of these eligibility requirements and their rationale see Whelpton, P. K. and Kiser, Clyde V.: Social and Psychological Factors Affecting Fertility. iv. Developing the Schedules, and Choosing the Type of Couples and the Area to be Studied. *The Milbank Memorial Fund Quarterly*, October, 1945, xxiii, No. 4, pp. 386-409 (Reprint pp. 139-162).

⁹ The basic assumption of statistical independence involved here is that of "in-

(Continued on page 295)

this point to list and define formally the various technical terms which are employed.

"Relatively Fecund" Couples. These are couples who reported at least four live births, and all other couples with three or fewer live births unless they knew or had good reason for believing that conception was physiologically impossible during a period of at least twenty-four or thirty-six consecutive months since marriage (twenty-four for never-pregnant couples, thirty-six for others). Failure to conceive during periods of this duration when contraception was not practiced "always" or "usually" was considered good reason for such belief. Of the total 1,977 couples, 1,444 were classified as "relatively fecund."

"Relatively Sterile" Couples. The remaining 533 couples were classified as "relatively sterile." It is well to bear in mind that these classifications of fecundity status were neither de-

pendent" monthly ovulations. The theoretical implications and limitations of this assumption, particularly as related to the logic of tests of significance, are discussed fully in Beebe, *op. cit.*, pp. 227-239. Despite the absence of complete agreement and final judgment on the justifications of this assumption, operational decisions have to be made. The problem forces itself upon the attention of the investigator at the outset in the question of what constitutes a reliable pregnancy rate. Previous investigators have computed pregnancy rates with denominators as low as 10 exposure years (Stix and Notestein, *op. cit.*). Another (Beebe, *op. cit.*) decided in favor of 500 exposure months (slightly over 40 years). The authors of the present study decided that 10 exposure-years is much too low since it is quite possible for this number of years to represent the experience of only one couple. It was felt that computing a rate for even as impressive a figure as 120 months of exposure is quite presumptuous if this aggregate represents the experience of only one couple. Information about exposure time only is insufficient unless the number of years is so high as to insure automatically a minimum number of couples. To establish a certain criterion based on number of couples alone is therefore necessary but still insufficient. In addition, there must be some assurance that these couples as a group have had an "adequate" period of exposure with, for example, a certain method of contraception. (This consideration applies only to pregnancy rates during periods of contraceptive exposure.) This lends confidence to an interpretation of a rate in terms of the protection afforded by the method rather than chance variation resulting from insufficient exposure. It was decided, therefore, that in order to have a minimum sampling reliability and statistical stability for the rate, it is necessary to incorporate both considerations—number of couples and length of exposure—into the criteria for the computation of a rate. These minimal requirements were defined arbitrarily at twenty couples and 50 exposure years for exposure during which time contraception was practiced. It is recognized that these precautions do not fully guarantee that each of the couples has had a sufficient amount of exposure for the evaluation of the effectiveness of a given method. The single criterion of twenty couples was maintained for pregnancy rates computed for periods of noncontraceptive exposure.

terminated medically nor designed to conform strictly to medical concepts of fecundity and sterility.

Exposure. This term is used to indicate the periods of time during which conception might have occurred. The number of months of such exposure was computed by subtracting from the total months of married life the months pregnant (and an additional one month per pregnancy for the puerperium),¹⁰ months sterile, months physically separated (if two or more months at a time) when neither pregnant nor sterile, and months when coitus was impossible for anatomical reasons. Separations included periods of two months or more during which the husband or wife was in a hospital.

For purposes of analysis, exposure to the risk of conception was divided into noncontraceptive and contraceptive exposure with various subclassifications.

Noncontraceptive Exposure:

A. Before Contraception Began. This category includes only exposure during the period preceding the first use of contraception. In other words, a married couple so classified had never had any contraceptive experience preceding this type of exposure. Other types of noncontraceptive exposure are accounted for in the following categories.

B. Stopped Contraception to Conceive. This includes all exposure of couples between the time they interrupted contraception in order to have a child and the time of conception or, with a few couples, until the time when they were interviewed or when they resumed contraception.

C. Stopped Contraception, Other. This denotes the small proportion of noncontraceptive exposure following the interruption of contraception for reasons other than a desire to conceive, e.g., the supply of contraceptive materials was temporarily ex-

¹⁰ It is realized that there is some disagreement about the period of time that should be discounted for the puerperium. A recent study, for example, has allowed three months after each birth. See PAPERS OF THE ROYAL COMMISSION ON POPULATION, VOL. I, FAMILY LIMITATION. London, His Majesty's Stationery Office, 1949, p. 109. This entire subject of the chance of conception in each postpartum month requires intensive research.

hausted, health reasons, no money to buy contraceptives, and religious objections.

Contraceptive Exposure:

A. Practiced Contraception "Always." Includes all exposure when contraception was practiced with no omissions or with rare omissions (not more than three or four times a year or 3 or 4 per cent of the time it was practiced).

B. Practiced Contraception "Usually." Differs from "always" in that omissions occurred more frequently but less than one-fourth to one-third of the times when coitus took place.

C. Practiced Contraception "Sometimes." Denotes all contraceptive exposure during which time contraception was omitted more than in the preceding classification but was not discontinued entirely.

All pregnancies occurring to the entire group studied were assigned to the appropriate exposure classification.

Periods "Definitely Sterile." This category is not considered "exposure" in the above sense of the term since by definition it is restricted to periods when conception was considered physiologically impossible for such reasons as a hysterectomy, a vasectomy, or a physician's statement (with or without reason) to the effect that the couple was incapable of conceiving. It was assumed that a period of "definite sterility" could be followed by a period of normal fecundity only as a result of surgery.

Contraceptive Methods. A total of twenty-two methods of contraception were coded for use in this study.¹¹ Although other methods were used, these twenty-two constitute the most frequently employed techniques. Eleven of the methods consist of one contraceptive (or procedure) used singly,¹² seven of two or more used in combination, and four of two or more used alternately.¹³

¹¹ The list appears recurrently in various tables throughout the text.

¹² "Diaphragm and Jelly" is classified here as a single method.

¹³ Periods when douche was reported to be used "for cleanliness only" are regarded for some purposes as contraceptive exposure and for others are omitted from

(Continued on page 298)

Income Classifications. The measure of income used is the average annual earnings of husband and wife combined since marriage. The categories defined as high, medium, and low correspond to average annual incomes of \$2,400 and over, \$1,600 to 2,399, and under \$1,600, respectively. For various reasons, involving noncomparability of data, the "relatively fecund" and "relatively sterile" couples have not been combined in the income classifications.¹⁴

Measure of Risk of Conception. The measure of chance of conception used in this study is the pregnancy rate which is defined as the number of pregnancies per 100 years of exposure. It was obtained by dividing the number of conceptions actually occurring by the number of months of exposure as defined above and multiplying by 1,200 in order to avoid unwieldy decimals. As explained in footnote 9, the minimal criterion adopted for the computation of this rate was 20 couples and 50 years of exposure.

Reversing this computation procedure and dividing the number of months of exposure by the number of conceptions results in the average number of exposure-months per conception. This average is employed in conjunction with the pregnancy rate in the analysis that follows.

the analysis. In the tables that follow these periods will be considered as contraceptive exposure unless otherwise noted. The general rule followed is to regard this exposure as contraceptive when the respondent's "performance" is being considered and as noncontraceptive when attention is focused on the respondent's "motive." Lactation, in this particular analysis, is not defined as a method of contraception.

¹⁴ The authors feel that the income data are not comparable for the two groups. For the "relatively fecund" couples the average incomes were computed from a detailed income history while the "relatively sterile" couples were asked simply to estimate their average annual income since marriage. It was felt that the answers to this single question probably were biased in favor of the years immediately preceding the interview and would not be likely to include all periods of unemployment, and hence gave less accurate results than the more extensive data available for the "relatively fecund" couples. The presumed unreliability of these data for the "relatively sterile" couples implies so many limitations on interpretation that it was decided to restrict income analysis primarily to the "relatively fecund" couples.

The inclusion of the wife's income in the data for "relatively fecund" couples results in a shift of one position (either from medium to high or from low to medium) for slightly under 20 per cent of the couples. In other words, over 80 per cent of the couples would be classified in the same group if the definition of income included only husband's average annual earnings since marriage. Nevertheless, the fact of wife's employment does have decided implications in reproductive behavior which are unaccounted for in this study.

The concept and derivation of the *Effectiveness Ratio*, which is also employed extensively in this study, is explained in a later section.

EXPOSURE AND PREGNANCIES WITH AND WITHOUT CONTRACEPTION

In most of the analysis that follows, a distinction is maintained between the experience before and after the first pregnancy. The reason for this is the anovulatory nature of certain months following childbirth. Exposure before the first pregnancy is by definition free of puerperal amenorrhea, lactation, and the more obscure processes which attend the recuperation and reorganization of the reproductive system following childbirth.¹⁵ During periods of postpartum exposure the chance of conception is greatly reduced.¹⁶ In addition to these considerations of a physiological nature, there is the reasonable expectation that proficiency in the use of contraception would improve after the first pregnancy¹⁷ because of a desire to space births properly, and also, if the first pregnancy was not wanted, because of an increased determination to prevent additional unwanted pregnancies. The importance of these combined influences, as reflected in lower pregnancy rates for exposure after the first pregnancy, is evidenced in many of the tables which appear in this study (Table 3 provides the first opportunity for this comparison). Sections of tables including data on "all pregnancies" are presented simply for summary purposes and are not intended to divert attention from the more refined analysis which takes into account the above differences.

The relation of the different types of exposure to income is presented in Table 1 and Figure 1. The first noteworthy fea-

¹⁵ Months of lactation are taken into account in a later section.

¹⁶ Cf. Beebe, *op. cit.*, p. 76. Beebe reports a noncontraceptive pregnancy rate of 105 for exposure outside of coincident amenorrhea and lactation in contrast to a rate of only 3 during such periods.

¹⁷ The "before first pregnancy" and "after first pregnancy" categories are not strictly comparable in another sense in that all of the same couples are not found in both groups. The main source of difference lies in the exclusion from the "after first pregnancy" group of the childless couples and the couples who were pregnant for the first time at interview.

TYPE OF EXPOSURE	"RELATIVELY FECUND"				"RELATIVELY STERILE"	ALL COUPLES
	Income of Couple					
	High	Medium	Low	Total		
ALL EXPOSURE						
Number of Exposure Years	2,976	5,383	5,057	13,416	4,776	18,192
Per Cent:						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Contraception Used, Total	94.7	95.8	93.2	94.6	36.7	79.5
"Always"	90.9	89.6	85.4	88.4	27.4	72.4
"Usually" or "Sometimes"	3.8	6.2	7.8	6.2	9.3	7.1
No Contraception Used, Total	5.3	4.2	6.8	5.4	63.3	20.5
"Before Contraception Began"	0.8	1.9	5.0	2.8	36.5	11.6
"Stopped Contraception to Conceive"	4.2	2.1	1.3	2.3	20.4	7.0
"Stopped Contraception, Other"	0.3	0.2	0.5	0.3	6.4	1.9
BEFORE FIRST PREGNANCY						
Number of Exposure Years	1,277	1,581	800	3,658	2,828	6,486
Per Cent:						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Contraception Used, Total	94.9	92.3	84.0	91.4	27.1	63.4
"Always"	90.5	84.1	73.4	84.0	19.5	55.9
"Usually" or "Sometimes"	4.4	8.2	10.6	7.4	7.6	7.5
No Contraception Used, Total	5.1	7.7	16.0	8.6	72.9	36.6
"Before Contraception Began"	1.1	4.6	13.0	5.2	44.7	22.4
"Stopped Contraception to Conceive"	4.0	2.8	2.8	3.2	22.9	11.8
"Stopped Contraception, Other"	0.0	0.3	0.2	0.2	5.3	2.4
AFTER FIRST PREGNANCY						
Number of Exposure Years	1,699	3,802	4,257	9,758	1,948	11,706
Per Cent:						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Contraception Used, Total	94.7	97.3	94.9	95.8	50.6	88.3
"Always"	91.3	92.0	87.7	90.0	38.8	81.5
"Usually" or "Sometimes"	3.4	5.3	7.2	5.8	11.8	6.8
No Contraception Used, Total	5.3	2.7	5.1	4.2	49.4	11.7
"Before Contraception Began"	0.5	0.8	3.5	1.9	24.6	5.7
"Stopped Contraception to Conceive"	4.3	1.7	1.0	1.9	16.7	4.3
"Stopped Contraception, Other"	0.5	0.2	0.6	0.4	8.1	1.7

Table 1. Proportion of exposure with and without contraception, for "relatively fecund" couples by income, and for "relatively sterile" couples and all couples.

ture of the data for "relatively fecund" couples is the lack of any substantial relationship between income and the proportion of exposure with contraception.¹⁸ The only instance of a

¹⁸ Some fragmentary evidence was obtained which suggested that this statement is not true for the "relatively sterile" couples. On the contrary, the statistical rela-

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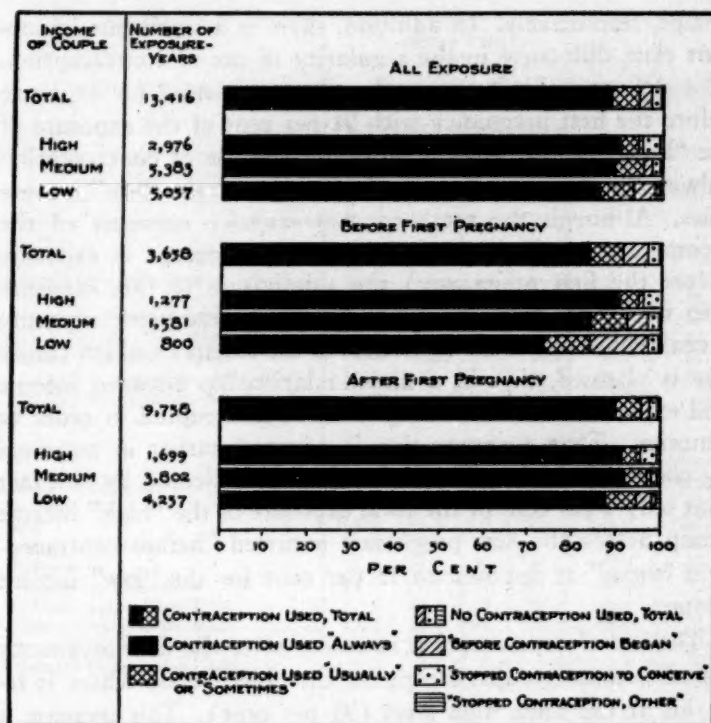


Fig. 1. Type of exposure to the risk of pregnancy for "relatively fecund" couples by income.

clear-cut relationship is found in exposure before the first pregnancy¹⁰ where the proportion of total exposure with contraception is 95 and 84 per cent for the "high" and "low"-income

tionships obtained indicate an irregular inverse relation of contraceptive exposure to income but are consistent with the pattern for the "relatively fecund" couples in retaining a direct association of income with noncontraceptive exposure following the interruption of contraception in order to conceive. These data are not presented here because of the aforementioned difficulties in classifying these couples by income (*see* footnote 14). It is hoped that the first-mentioned author of this study will be able to explore this entire subject of sterility and socio-economic status in a future study. Some preliminary conferences have already produced agreement that this problem and an analysis of noncontraceptive fertility both deserve much more attention than can be given to them here.

¹⁰ It is quite possible that greater differences may have been discovered if the sample had not been so homogeneous, that is, restricted to native-white, urban couples of at least eighth grade education.

groups, respectively. In addition, there is a small but important class difference in the regularity of use of contraception. This difference is also more sharply pronounced for exposure before the first pregnancy with 91 per cent of the exposure of the "high" income class manifesting the use of contraception "always" in contrast to only 73 per cent for the "low" income class. Although the total *noncontraceptive* exposure of the income groups shows no definite pattern (except in exposure before the first pregnancy) the subdivision of this exposure into two quite different types of noncontraceptive exposure reveals consistent class differences in the extent to which family size is planned, that is, a direct relationship between income and exposure when contraception was interrupted in order to conceive. That contraception is adopted earlier in marriage by couples in higher-income brackets is indicated by the fact that only 1 per cent of the total exposure of the "high" income group before the first pregnancy occurred "before contraception began" as opposed to 13 per cent for the "low" income group.

The use of contraception increases after the first pregnancy for all income groups, except for the "high" class where it remains at the same high level (95 per cent). This increase is due to several factors, one of them being the gain in knowledge of contraception which frequently accompanies obstetrical service. The primary reason, however, is probably an intensified determination to control reproduction. Fully 40 per cent of all first pregnancies of the "relatively fecund" group were definitely accidental, i.e., occurred while contraception was being practiced. An additional 30 per cent were "unplanned" in another sense, since they occurred before contraception began²⁰ (see Table 2).

The contraceptive practice of the "relatively sterile" couples increases even more, from 27 per cent of all exposure before the first pregnancy to 51 per cent after this event. The ratio

²⁰ For an elaboration of the fertility-planning classifications, see Whelpton and Kiser, *op. cit.*, vi. The Planning of Fertility, pp. 74-85 (Reprint pp. 220-231).

TYPE OF EXPOSURE	"RELATIVELY FECUND"				"RELATIVELY STERILE"	ALL COUPLES
	Income of Couple					
	High	Medium	Low	Total		
ALL PREGNANCIES						
Number of Pregnancies	541	1,027	1,414	2,982	570	3,552
Per Cent:						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Contraception Used, Total	41.8	40.3	50.1	52.6	30.0	48.0
"Always"	32.4	37.3	45.9	40.5	15.4	36.4
"Usually" or "Sometimes"	9.4	12.0	13.2	12.1	14.6	12.5
No Contraception Used, Total	58.2	59.7	49.9	47.4	70.0	51.9
"Before Contraception Began"	7.4	16.8	24.6	18.8	41.6	22.5
"Stopped Contraception to Conceive"	49.9	32.7	14.1	27.0	24.6	26.6
"Stopped Contraception, Other"	0.9	1.2	2.2	1.6	3.8	2.0
FIRST PREGNANCIES						
Number of Pregnancies	263	491	501	1,255	326	1,581
Per Cent:						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Contraception Used, Total	30.5	38.5	41.0	40.1	25.5	37.1
"Always"	28.5	26.9	30.1	28.5	15.4	25.8
"Usually" or "Sometimes"	11.0	11.6	11.8	11.6	10.1	11.3
No Contraception Used, Total	69.5	61.5	58.9	59.9	74.5	62.9
"Before Contraception Began"	10.3	26.9	42.7	29.7	46.6	33.2
"Stopped Contraception to Conceive"	49.4	33.8	14.6	29.4	24.5	28.4
"Stopped Contraception, Other"	0.8	0.8	0.8	0.8	3.4	1.3
LATER PREGNANCIES						
Number of Pregnancies	278	536	913	1,727	244	1,971
Per Cent:						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Contraception Used, Total	43.9	50.1	68.4	61.6	36.1	58.4
"Always"	36.0	46.8	54.5	49.2	15.6	45.0
"Usually" or "Sometimes"	7.9	12.3	13.9	12.4	20.5	13.4
No Contraception Used, Total	56.1	49.9	31.6	38.4	63.9	41.6
"Before Contraception Began"	4.7	7.7	14.7	10.9	34.8	13.9
"Stopped Contraception to Conceive"	50.3	31.7	13.9	25.3	24.6	25.2
"Stopped Contraception, Other"	1.1	1.5	3.0	2.2	4.5	2.5

Table 2. Proportion of conceptions occurring with and without contraception, for "relatively fecund" couples by income, and for "relatively sterile" couples and all couples.

of contraceptive to noncontraceptive exposure for the "relatively sterile" couples differs significantly from that of the "relatively fecund" couples. During only 37 per cent of all exposure did the "relatively sterile" couples use contraception

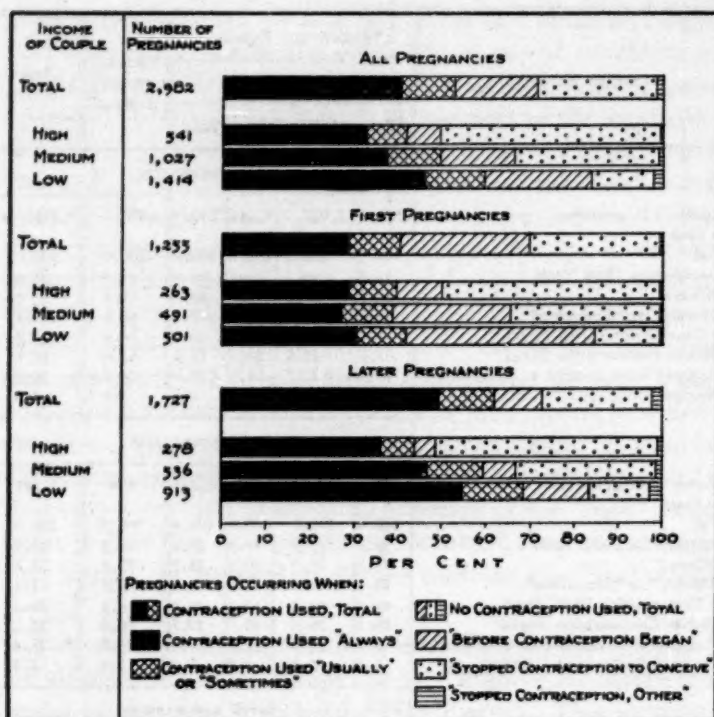


Fig. 2. Proportion of pregnancies occurring by type of exposure for "relatively fecund" couples by income.

as compared to 95 per cent for the "relatively fecund" group. This wide discrepancy can best be understood when we consider that for many of the couples classified as "relatively sterile" the main problem was to have a child, whereas for many of the "relatively fecund" couples²¹ it was to prevent or control conception.

The proportion of pregnancies that occurred during these different types of exposure is presented in Table 2 and Figure 2. A striking feature of this tabulation is the fact that over half (53 per cent) of all the conceptions experienced by the "relatively fecund" group were conceived during periods of exposure to

²¹ Cf. Kiser and Whelpton, *op. cit.*, ix. Fertility Planning and Fertility Rates by Socio-Economic Status, p. 209 (Reprint p. 380).

tively fecund" couples occurred during periods when contraception was being practiced and over 40 per cent occurred while contraception was being practiced "always." It must be remembered, of course, that 95 per cent of all exposure was with contraception, and that the rate of conception during exposure with contraception is only *one-sixteenth* of the rate without contraception (*see* Table 3). Nevertheless, this high proportion of accidental pregnancies certainly indicates in part

Table 3. Pregnancies per 100 years exposure, for "relatively fecund" couples by income, and for "relatively sterile" couples and all couples.

TYPE OF EXPOSURE	"RELATIVELY FECUND"				"RELATIVELY STERILE"	ALL COUPLES
	Income of Couple					
	High	Medium	Low	Total		
ALL PREGNANCIES						
All Exposure	18	19	28	22	12	20
Contraception Used, Total	8	10	18	12	10	12
"Always"	6	8	15	10	7	10
"Usually" or "Sometimes"	45	37	48	43	19	35
No Contraception Used, Total	202	233	168	195	13	48
"Before Contraception Began"	171	170	138	149	14	38
"Stopped Contraception to Conceive"	218	302	298	267	14	74
"Stopped Contraception, Other"	*	*	119	105	7	20
FIRST PREGNANCY						
All Exposure	21	31	63	34	12	24
Contraception Used, Total	9	13	31	15	11	14
"Always"	6	10	26	12	9	11
"Usually" or "Sometimes"	52	44	69	54	15	37
No Contraception Used, Total	244	240	228	240	12	42
"Before Contraception Began"	188	181	206	195	12	36
"Stopped Contraception to Conceive"	258	375	320	314	12	59
"Stopped Contraception, Other"	*	*	*	*	7	14
AFTER FIRST PREGNANCY						
All Exposure	16	14	21	18	13	17
Contraception Used, Total	8	9	16	11	9	11
"Always"	6	7	13	10	5	9
"Usually" or "Sometimes"	38	33	42	38	22	33
No Contraception Used, Total	172	214	133	161	16	60
"Before Contraception Began"	*	142	91	101	18	41
"Stopped Contraception to Conceive"	191	253	286	236	18	98
"Stopped Contraception, Other"	*	*	109	95	7	25

* Rates not computed for base of less than twenty couples.

the extent to which contraception as practiced was not as effective as desired.

The relationships of primary concern in this analysis are shown more satisfactorily in Table 3 where exposure and conceptions can be considered jointly in the form of pregnancy rates, and in Table 4 (Figures 3 and 4) where the data are presented in terms of average number of exposure-months per

Table 4. Mean number of exposure-months per conception for periods when no contraception was practiced, for "relatively fecund" couples by income, and for "relatively sterile" couples and all couples.

TYPE OF EXPOSURE	"RELATIVELY FECUND"				"RELATIVELY STERILE"	ALL COUPLES
	Income of Couple					
	High	Medium	Low	Total		
	ALL PREGNANCIES					
All Exposure	66	63	43	54	101	61
Contraception Used, Total	150	122	68	97	123	100
"Always"	186	151	80	118	178	122
"Usually" or "Sometimes"	27	32	25	28	64	35
No Contraception Used, Total	6	5	7	6	91	25
"Before Contraception Began"	7	7	9	8	88	32
"Stopped Contraception to Conceive"	6	4	4	5	83	16
"Stopped Contraception, Other"	*	*	10	11	168	60
	FIRST PREGNANCY					
All Exposure	58	39	19	35	104	49
Contraception Used, Total	140	93	38	80	111	84
"Always"	185	121	47	103	133	107
"Usually" or "Sometimes"	23	27	17	22	78	33
No Contraception Used, Total	5	5	5	5	102	29
"Before Contraception Began"	6	7	6	6	100	33
"Stopped Contraception to Conceive"	5	3	4	4	97	20
"Stopped Contraception, Other"	*	*	*	*	162	88
	AFTER FIRST PREGNANCY					
All Exposure	73	85	56	68	96	71
Contraception Used, Total	158	140	78	105	134	108
"Always"	186	167	90	124	239	129
"Usually" or "Sometimes"	32	37	29	32	55	36
No Contraception Used, Total	7	6	9	7	74	20
"Before Contraception Began"	*	8	13	12	68	29
"Stopped Contraception to Conceive"	6	5	4	5	65	12
"Stopped Contraception, Other"	*	*	11	13	173	49

* Averages not computed for less than twenty couples.

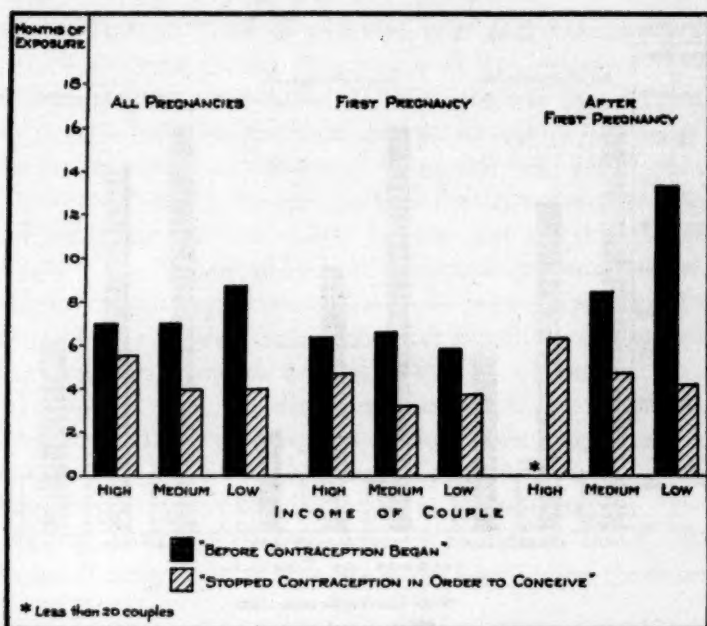


Fig. 3. Mean number of exposure-months per conception for periods when no contraception was practiced, for "relatively fecund" couples by income.

conception. A consistent pattern which can be discerned in these and similar data in other studies is the higher pregnancy rate for exposure while contraception was interrupted in order to conceive as compared to the rates for noncontraceptive exposure before contraception began. The pregnancy rates for the two types of exposure for "relatively fecund" couples are, respectively, 314 and 195 for the first pregnancy and 236 and 101 for all later pregnancies. The two types of exposure are the same in the sense that both are experienced without contraception. Why there should be such consistent differences in these pregnancy rates has not been explained completely. The consensus seems to be that part of the difference in the two rates for conceptions *after* the first pregnancy can be attributed to the probability that the planned pregnancy type of exposure favors quick conception in that, unlike exposure after the first

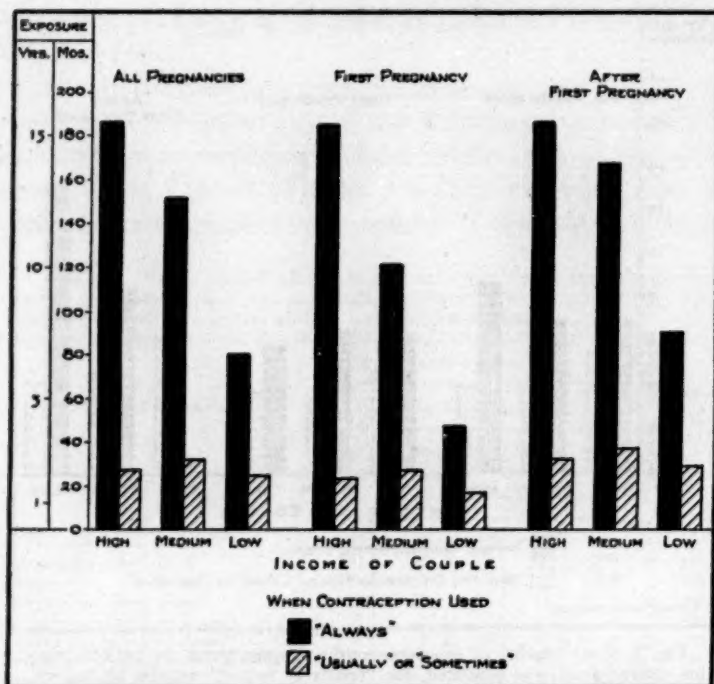


Fig. 4. Mean number of exposure-months per conception for periods when contraception was practiced, for "relatively fecund" couples by income.

pregnancy prior to the first use of contraception, it contains no periods of protective amenorrhea or lactation.²² The difference between these two rates for first pregnancies is less easily explained. A good part of the explanation may involve a tendency for couples to underestimate, in retrospect, the time it took to conceive after interrupting contraception for this purpose. A more active sex life during these periods has been suggested by some²³ but it seems doubtful that couples will reach any higher level than those using no contraception just after marriage. Another hypothesis is that couples who stop

²² Stix and Notestein, *op. cit.*, p. 68; Beebe, *op. cit.*, p. 65; and Whelpton and Kiser, *op. cit.*, vi. The Planning of Fertility, p. 99 (Reprint p. 245).

²³ Beebe, *op. cit.*, p. 65; PAPERS OF THE ROYAL COMMISSION ON POPULATION, *op. cit.*, VOL. I. FAMILY LIMITATION, p. 115.

contraception in order to conceive may plan consciously to have intercourse during that period of the menstrual cycle most favorable for conception.²⁴ While this may be a plausible explanation for some groups it appears untenable for the couples in this study. In this group during the years under observation (1927-1941), the relation between time of menstruation and ovulation was not widely known, and the days in the *middle* of the menstrual cycle were commonly considered the "safest." Other explanations that have been offered are: (a) women who plan their conceptions are usually at the age and in a condition of health most favorable for conception;²⁵ and (b) a period when the degree of entrance is not complete is much more likely to delay conception when couples use no contraception in the months immediately following marriage than when they stop contraception at a later time.²⁶

In any event, the evidence appears to indicate clearly that the use of contraception does not in the least reduce the fecundity of the user.²⁷

It is apparent in Table 3 that although there are large and statistically significant²⁸ variations in the noncontraceptive pregnancy rates by income, there is no discernible systematic pattern of association.²⁹ This apparent lack of relationship plus the similar findings of other analyses of noncontraceptive

²⁴ Beebe, *op. cit.*, p. 65.

²⁵ *Ibid.*

²⁶ Stix and Notestein, *op. cit.*, p. 70; Whelpton and Kiser, *op. cit.*, vi. The Planning of Fertility, p. 99 (Reprint p. 245).

²⁷ Cf. Stix and Notestein, *op. cit.*, p. 70.

²⁸ The differences among the rates for the three income classes for the "No Contraception Used, Total" and the "Stopped Contraception to Conceive" exposure are statistically significant at the 1 per cent level of probability. For the "Before Contraception Began" exposure for the first pregnancy the differences are not statistically significant but for "after the first pregnancy" they are significant between the 1 per cent and 2 per cent probability levels and for all pregnancies are significant between the 2 per cent and 5 per cent levels.

²⁹ As indicated in footnote 18, a more detailed study concentrating entirely on noncontraceptive fertility is being considered. For an analysis of the effect of certain physiological phenomena on variations in noncontraceptive fertility see Stix, Regine K.: Factors Underlying Individual and Group Differences in Uncontrolled Fertility. The Milbank Memorial Fund *Quarterly*, July, 1940, xviii, No. 3, pp. 239-256.

fertility³⁰ reaffirms the assumption of the absence of systematic class differences in fecundity. The differences in pregnancy rates by income which appear for "all exposure," therefore, must be attributed to differences in the extent and effectiveness of contraceptive practices. More specifically, the variation is associated primarily with class differences in the effectiveness of contraception when it is practiced "always." In other words, regularity of use is less important than proficiency of use as an explanation of class differences in conception rates among these Indianapolis couples. To this question of differences in proficiency of use must be added the related and equally important question of whether there are class differentials in the use of *methods* of contraception which themselves vary in effectiveness.

INCOME-CLASS DIFFERENCES IN THE METHODS OF CONTRACEPTION USED

Although twenty-two methods have been coded for analysis in this study, attention will be directed primarily at the more common single methods—the various douches, condom, withdrawal, diaphragm and jelly, suppository, jelly—and only occasionally at others. Although a few of the remaining methods are used more frequently than some of these, the fact that they are used either in combination or alternately with other methods increases the difficulty of interpretation.³¹

The methods used by the largest proportions of couples are: condom; water, Lysol, and "other" douches; and diaphragm and jelly (*see* Tables 5 and 6). The extent to which condom was used as a single method (28 per cent of all couples having used condom by itself) agrees well with findings of previous

³⁰ Various studies have revealed absences of systematic group differences in fecundity, whether defined in economic, religious, racial, or occupational terms. "Fecundity" has been inferred from noncontraceptive pregnancy rates.

See Stix and Notestein, *op. cit.*, pp. 39-41; Beebe, *op. cit.*, pp. 80-84; PAPERS OF THE ROYAL COMMISSION ON POPULATION, *op. cit.*, VOL. I, FAMILY LIMITATION, pp. 128-129; Pearl, *op. cit.*, pp. 25-26; Stix, Regine K.: Birth Control in a Midwestern City. I. Contraception and Fertility Before Clinic Attendance. *The Milbank Memorial Fund Quarterly*, January, 1939, xvii, No. 1, pp. 79-81 (Reprint pp. 79-81).

³¹ This difficulty is, of course, greatest when the questions of effectiveness and acceptability are raised. Nevertheless, data on all twenty-two methods will be presented when feasible in the tables that follow.

METHOD OF CONTRACEPTION	"RELATIVELY FECUND"				"RELATIVELY STERILE"	ALL COUPLES
	Income of Couple					
	High	Medium	Low	Total		
Total Number of Couples	329	569	543	1,444	533	1,974
Number Practicing Contraception at Any Time	329	569	537	1,435 ¹	370	1,805
Number Never Practicing Contraception	—	—	6	6	163	169
Per Cent of Couples Practicing Contraception Who Used the Following Methods: ²						
Douche, Water	12.2	12.1	17.1	14.0	20.5	15.3
Douche, Lysol	9.1	14.9	19.0	15.1	10.5	14.2
Douche, Salt and/or Soda	3.3	4.6	9.1	6.0	7.0	6.2
Douche, Zonite	6.1	4.4	0.7	3.4	2.4	3.2
Douche, Other ³	13.7	15.5	19.2	16.4	21.9	17.6
Condom	29.2	31.3	25.7	28.7	23.0	27.5
Withdrawal	5.8	4.7	8.4	6.3	5.1	6.1
Diaphragm and Jelly ⁴	17.3	12.8	16.6	15.3	4.3	13.0
Suppository	3.3	6.7	13.0	8.3	7.0	8.0
Jelly ⁵	4.9	2.3	1.1	2.4	2.2	2.4
Safe Period	2.7	1.8	2.4	2.2	2.2	2.2
Condom and Water Douche	6.7	6.2	5.8	6.1	2.7	5.4
Condom and Lysol Douche	4.0	3.7	1.7	3.0	0.3	2.4
Condom and Other Douche ⁶	4.6	6.5	3.5	4.9	2.7	4.5
Withdrawal and Douche ⁷	2.7	3.2	3.9	3.3	1.9	3.0
Diaphragm, Jelly, and Douche ⁸	1.2	2.3	1.7	1.8	0.0	1.4
Suppository and Douche ⁹	2.1	6.3	4.8	4.8	2.2	4.3
Safe Period and Douche ⁹	1.5	1.6	1.3	1.5	0.5	1.3
Condom or Douche ⁹	8.5	7.2	10.4	8.7	2.4	7.4
Condom or Douche, or Condom and Douche ⁹	2.7	4.0	6.0	4.5	3.0	4.2
Condom or Withdrawal	4.3	3.7	5.6	4.5	0.5	3.7
Withdrawal or Douche, or Withdrawal and Douche ⁹	2.7	1.9	4.8	3.2	2.4	3.0

Table 5. "Relatively fecund" couples by income, and "relatively sterile" couples and all couples regardless of income, by contraceptive methods used.

¹ Excludes three couples of unknown income.

² The percentages in this table do not add to 100 because many couples used more than one method during their married life.

³ Includes the alternate use of different solutions.

⁴ Diaphragm (or pessary) and jelly, with or without douche the following morning.

⁵ With or without douche the following morning.

⁶ Any douche.

⁷ Diaphragm (or pessary), jelly, and douche (any) used immediately afterwards.

⁸ Includes condom, or condom and douche (any); douche (any), or condom and douche (any); condom or douche (any), or condom and douche (any).

⁹ Includes withdrawal or douche (any); withdrawal, or withdrawal and douche (any); douche (any), or withdrawal and douche (any); withdrawal or douche (any), or withdrawal and douche (any).

studies of contraceptive practices.³² The most marked varia-

³² For a discussion and comparison of these results see Riley, John Winchell and (Continued on page 312)

tion in methods used between this and other study groups is the comparatively low reliance on withdrawal or *coitus interruptus* by itself which was used by only 6 per cent of the couples.³³ One study of several thousand couples in a socio-economic range roughly similar to that of the Indianapolis sample reports a similar figure of 4 per cent.³⁴ The primary explanation of the difference between these low percentages and those varying around 30 per cent reported by previous studies of birth-control clinic patients would seem to be that such couples tend to have a relatively low socio-economic status and to be actively dissatisfied, for various reasons, with whatever methods they were using prior to clinic attendance. The absence of such biases probably accounts for the fact that "diaphragm and jelly" was used more by the Indianapolis couples than by the couples who attended a birth control clinic.³⁵

There are systematic differences by income in the proportions of couples ever using some of the methods listed in Table 5. A better measure of use in this connection is the ratio of exposure with each of these methods to total contraceptive exposure shown in Tables 6-8. It is evident that the use of the various kinds of douches, except Zonite douche, tends to vary inversely with income, a relationship which is consistent with the findings of other studies.³⁶ The use of condom, on the

White, Matilda: The Use of Various Methods of Contraception. *American Sociological Review*, December, 1940, 5, No. 6, pp. 899-903. They report Cautley and Beebe's conclusion "that the condom accounts for about 24 per cent of all contraceptive practice." (p. 901.)

Also see Himes, Norman E.: MEDICAL HISTORY OF CONTRACEPTION. Baltimore, The Williams and Wilkins Company, 1936, pp. 335-352, and Beebe, Gilbert W. and Gamble, Clarence J.: The Effect of Contraception Upon Human Fertility. *Human Biology*, 10, No. 3, 1938, p. 378.

³³ No precise comparisons with the results of previous studies are attempted in the study because of the many important differences in types of couples studied, time periods covered, and slight differences in methods of analysis that characterize these studies.

³⁴ Riley and White, *op. cit.*, p. 901.

³⁵ The Riley and White study shows that 18 per cent of the total number of contraceptors (2,005) had used diaphragm and jelly. *Ibid.*, Table 6, p. 896.

³⁶ For example, see *ibid.*, p. 901; Stix, Regine K., Contraception and Fertility Before Clinic Attendance, *op. cit.*, p. 84 (these data are classified on the basis of occupation).

METHOD OF CONTRACEPTION	"RELATIVELY FECUND"				"RELATIVELY STERILE"	ALL COUPLES
	Income of Couple					
	High	Medium	Low	Total		
Total Years of Contraceptive Exposure	2,820	5,160	4,712	12,692	1,753	14,445
<i>Per Cent:</i>						
Total, All Methods	100.0	99.9	99.9	99.9	99.9	100.0
<i>Douches, All Kinds Used Singly</i>	23.7	30.5	34.6	30.5	27.0	33.1
Douche, Water	6.1	6.2	9.1	7.3	14.6	8.2
Douche, Lysol	4.3	7.6	9.5	7.5	4.0	7.1
Douche, Salt and/or Soda	2.0	3.8	4.1	3.5	7.4	4.0
Douche, Zonite	3.7	2.7	0.3	2.0	2.1	2.0
Douche, Other	7.6	10.2	11.6	10.2	23.9	11.8
Condom	20.8	23.5	19.2	21.3	18.7	21.0
Withdrawal	5.3	2.4	5.8	4.3	2.2	4.0
Diaphragm and Jelly	10.0	6.9	7.1	7.6	2.1	7.0
Suppository	2.5	2.7	4.9	3.5	3.7	3.5
Jelly	3.5	0.8	0.4	1.3	1.5	1.3
Safe Period	1.6	0.5	0.7	0.8	1.6	0.9
Condom and Water Douche	5.6	4.6	2.6	4.1	1.6	3.8
Condom and Lysol Douche	2.9	3.0	0.8	2.1	*	1.9
Condom and Other Douche	3.7	5.6	2.8	4.1	3.2	4.0
Withdrawal and Douche	2.1	2.6	1.9	2.2	1.8	2.2
Diaphragm, Jelly, and Douche	0.8	1.2	0.4	0.8	0.0	0.7
Suppository and Douche	2.1	3.2	1.3	2.3	1.6	2.2
Safe Period and Douche	0.8	1.2	0.8	1.0	0.1	0.9
Condom or Douche	5.3	3.8	6.1	5.0	3.9	4.9
Condom or Douche, or Condom and Douche	2.3	2.3	3.6	2.8	3.2	2.8
Condom or Withdrawal	5.1	3.5	4.2	4.1	0.4	3.7
Withdrawal or Douche, or Withdrawal and Douche	1.9	1.6	2.7	2.1	2.3	2.1

Table 6. Proportion of all contraceptive exposure with specified methods, for "relatively fecund" couples by income, and for "relatively sterile" couples and all couples.¹

* Less than six months exposure.

¹ See Table 5, footnotes 2-9.

other hand, is not systematically associated with the income of the couples.³⁷ It may be, as Riley and White suggest among other reasons, that "the use of condom may tend to increase

³⁷ Past studies have been inconsistent in their findings on the relation of class to the use of the condom. The Pearl and Stix studies show a direct relationship; the Riley and White data show a very slight inverse relation. No pattern of association is discernible from the data from the recent British study. See PAPERS OF THE ROYAL COMMISSION ON POPULATION, *op. cit.*, Vol. I, FAMILY LIMITATION, pp. 134-137. This comparison is not necessarily valid since the measure for this latter study is the months of exposure with individual appliance methods expressed as a proportion of all appliance exposure.

METHOD OF CONTRACEPTION	"RELATIVELY FECUND"				"RELATIVELY STERILE"	ALL COUPLES
	Income of Couple					
	High	Medium	Low	Total		
Total Years of Contraceptive Exposure Before First Pregnancy	1,212	1,460	672	3,344	767	4,111
Per Cent:						
Total, All Methods	99.9	100.0	99.9	100.0	99.9	100.0
Douches, All Kinds Used Singly	34.6	36.9	52.5	39.5	62.6	43.6
Douche, Water	10.0	7.1	18.0	10.4	19.6	12.1
Douche, Lysol	5.0	9.3	12.9	8.5	5.3	7.9
Douche, Salt and/or Soda	2.5	3.4	3.4	3.1	9.8	4.3
Douche, Zonite	5.6	4.1	0.0	3.8	4.5	4.0
Douche, Other	11.5	13.0	18.2	13.5	23.4	15.3
Condom	19.2	23.3	18.0	20.7	14.4	19.6
Withdrawal	6.2	1.9	4.2	3.9	1.8	3.5
Diaphragm and Jelly	4.7	3.3	0.0	3.1	0.5	2.7
Suppository	0.1	2.0	4.8	1.9	2.2	1.9
Jelly	0.5	0.0	0.0	0.2	0.0	0.2
Safe Period	2.0	0.7	2.7	1.6	0.3	1.3
Condom and Water Douche	4.4	3.4	0.4	3.2	2.7	3.1
Condom and Lysol Douche	0.7	0.4	0.0	0.5	*	0.4
Condom and Other Douche	5.4	8.1	2.7	6.0	0.5	5.0
Withdrawal and Douche	1.0	2.7	4.3	2.4	0.4	2.0
Diaphragm, Jelly, and Douche	0.2	0.0	0.0	0.1	0.0	0.1
Suppository and Douche	2.8	3.3	0.5	2.5	2.5	2.5
Safe Period and Douche	1.1	0.2	1.1	0.7	0.0	0.6
Condom or Douche	4.7	4.4	1.5	3.9	8.1	4.7
Condom or Douche, or Condom and Douche	2.5	1.3	5.3	2.6	3.9	2.8
Condom or Withdrawal	7.0	5.0	0.6	4.8	0.0	3.9
Withdrawal or Douche, or Withdrawal and Douche	2.8	3.1	1.3	2.6	0.0	2.1

Table 7. Proportion of contraceptive exposure before the first pregnancy with specified methods, for "relatively fecund" couples by income, and for "relatively sterile" couples and all couples.¹

* Less than six months exposure.

¹ See Table 5, footnotes 2-9.

with economic status only up to a certain income level."³⁸ The

³⁸ *Op. cit.*, pp. 901-902. The class divisions employed in their study represent actually only a breakdown of the urban "upper-middle" class. The Indianapolis couples, although not as narrowly restricted in terms of socio-economic status are, nevertheless, more homogeneous than the general population. Of the 1,444 "relatively fecund" couples, for example, only eleven couples reported average annual incomes since marriage of \$6,000 or over which strongly suggests the absence of an "upper" class in any sense of the term. On the other hand, the educational restrictions which limited inclusion in the sample to couples with at least a grade school education and the small number of husbands (29) whose longest occupation since marriage was below the level of semi-skilled indicates the absence of any real "lower" class.

use of "diaphragm and jelly" tends to increase with income, as might be expected. Almost half of the 89 couples in the "low" income class who used this method first learned about it from a clinic after several pregnancies had occurred already. The use of the suppository tends to vary inversely with income before the first pregnancy, while reliance on jelly alone exhibits a direct association after the first pregnancy. With neither withdrawal nor "safe period" is there a marked relation between income and use. Only two of the combined methods re-

Table 8. Proportion of contraceptive exposure after the first pregnancy with specified methods, for "relatively fecund" couples by income, and for "relatively sterile" couples and all couples.¹

METHOD OF CONTRACEPTION	"RELATIVELY FECUND"				"RELATIVELY STERILE"	ALL COUPLES
	Income of Couple					
	High	Medium	Low	Total		
Total Years of Contraceptive Exposure After First Pregnancy	1,608	3,700	4,040	9,348	986	10,334
<i>Per Cent:</i>						
Total, All Methods	100.0	100.0	100.0	100.0	99.9	99.9
<i>Douches, All Kinds Used Singly</i>	<i>15.4</i>	<i>28.0</i>	<i>31.5</i>	<i>27.5</i>	<i>43.6</i>	<i>29.0</i>
Douche, Water	3.2	5.9	7.7	6.2	10.7	6.6
Douche, Lysol	3.7	6.9	8.9	7.2	3.0	6.8
Douche, Salt and/or Soda	1.6	4.0	4.1	3.7	5.6	3.9
Douche, Zonite	2.3	2.1	0.3	1.4	0.1	1.3
Douche, Other	4.6	9.1	10.5	9.0	24.2	10.4
Condom	22.0	23.6	19.4	21.5	22.1	21.6
Withdrawal	4.7	2.6	6.0	4.4	2.4	4.2
Diaphragm and Jelly	14.1	8.3	8.2	9.3	3.4	8.7
Suppository	4.3	3.0	4.9	4.1	4.9	4.1
Jelly	5.8	1.0	0.5	1.6	2.7	1.7
Safe Period	1.3	0.5	0.4	0.6	2.7	0.8
Condom and Water Douche	6.4	5.1	3.0	4.4	0.8	4.1
Condom and Lysol Douche	4.5	4.0	0.9	2.7	0.0	2.5
Condom and Other Douche	2.4	4.7	2.8	3.5	5.2	3.6
Withdrawal and Douche	2.8	2.6	1.6	2.2	2.9	2.2
Diaphragm, Jelly, and Douche	1.3	1.7	0.4	1.1	0.0	1.0
Suppository and Douche	1.6	3.1	1.5	2.1	0.9	2.0
Safe Period and Douche	0.6	1.7	0.8	1.1	0.2	1.0
Condom or Douche	5.8	3.6	6.9	5.4	0.6	4.9
Condom or Douche, or Condom and Douche	2.2	2.6	3.4	2.9	2.7	2.9
Condom or Withdrawal	3.7	2.9	4.8	3.8	0.7	3.5
Withdrawal or Douche, or Withdrawal and Douche	1.1	1.0	3.0	1.9	4.1	2.1

¹ See Table 5, footnotes 2-9.

veal any persistent relationship between use and income. These are "condom and water douche" and "condom and Lysol douche" both of which show a positive association.

Comparison of the "relatively fecund" with the "relatively sterile" couples reveals a much higher proportion of exposure with douches (except Lysol douche) for the latter group, due mostly to large differences for water douche and "other" douche (*see* Tables 6-8). This is probably due in important degree to the fact that many of these "relatively sterile" couples did not feel the need to take greater precautions against conception.

The proportionate use of the different contraceptive methods changes significantly after the first pregnancy (compare Tables 7 and 8). The most pronounced change is found in the use of douches which decreases from 44 per cent of all exposure before the first pregnancy (for all couples) to 29 per cent after this event. Conversely, the use of diaphragm and jelly, suppository, jelly, and condom increases. These changes, as will be demonstrated in a later section of this report, reflect in large measure the trend toward the use of more effective methods which accompanies dissatisfaction with the method previously used, partly because it failed at the time of first conception, and partly because of the opportunity for medical consultation which is afforded by the experience of pregnancy.

THE COMMUNICATION OF INFORMATION ABOUT CONTRACEPTIVE METHODS AND THEIR ACCEPTABILITY

Before proceeding to an examination of the effectiveness of the different methods of contraception, it is helpful to obtain some insight into the background factors which collectively influenced the wives in this study to select certain methods rather than others.³⁹ To a large extent, the period of life when contraceptive methods were first learned about and first used, and the channels through which this information was dis-

³⁹ Early in the experimental field work it was decided for practical reasons to obtain information about contraceptive practice only from the wives.

Table 9. Interval in which wives first heard of method, for all couples ever using the method.¹

METHOD OF CONTRACEPTION ²	NUMBER EVER USING ³ METHOD	WHEN FIRST HEARD OF METHOD (CUMULATIVE PERCENTAGES) ⁴			
		Before Marriage	Between Marriage and First Pregnancy ⁵	Between First and Second Pregnancies	Between Second and Third Pregnancies
ALL CONTRACEPTION	1,743	38.5	83.1	95.4	98.6
Douche, Water	181	38.7	86.2	95.0	97.2
Douche, Lyeol	234	39.3	75.2	92.3	97.9
Douche, Salt and/or Soda	82	23.2	61.0	87.8	97.6
Douche, Zonite	55	34.5	90.9	100.0	100.0
Douche, Other	268	38.1	73.9	87.7	97.8
Condom	471	32.7	73.3	88.8	95.8
Withdrawal	91	19.8	58.3	88.0	93.5
Diaphragm and Jelly	227	5.3	15.4	40.1	67.9
Suppository	143	9.8	35.7	74.2	86.1
Jelly	40	0.0	5.0	55.0	72.5
Safe Period	33	48.5	60.6	84.8	93.9
Condom and Water Douche	90	38.9	70.0	90.0	92.2
Condom and Lyeol Douche	39	23.1	56.4	94.9	100.0
Condom and Other Douche	71	39.4	71.8	100.0	100.0
Withdrawal and Douche	45	24.4	62.2	91.1	93.3
Diaphragm, Jelly and Douche	26	0.0	3.8	26.9	57.7
Suppository and Douche	75	10.7	48.0	70.7	85.4
Safe Period and Douche	23	30.4	52.1	86.9	91.2
Condom or Douche	117	38.5	67.6	97.5	99.2
Condom or Douche, or Condom and Douche	66	39.4	75.8	92.5	97.0
Condom or Withdrawal	55	29.1	63.6	92.7	100.0
Withdrawal or Douche, or Withdrawal and Douche	47	19.1	68.0	85.0	89.3

¹ See Table 5, footnotes 2-9.² In this table douching "for cleanliness only" is not considered contraception.³ Excludes those wives who reported the time of first information as unknown.⁴ Wives who had a pregnancies and first heard of the method after the nth pregnancy are shown as having heard of it between the nth and nth +1 pregnancies.⁵ Includes wives who reported first hearing of method "at marriage."

METHOD OF CONTRACEPTION ¹	WHEN FIRST HEARD OF METHOD ² (CUMULATIVE PERCENTAGES)					
	Before Marriage			From Marriage to Before First Pregnancy		
	Income of Couple					
	High	Medium	Low	High	Medium	Low
ALL CONTRACEPTION	48.2	36.2	29.9	95.1	82.7	71.9
Douche, Water	40.6	37.5	29.3	100.0	91.7	70.7
Douche, Lysol	62.1	41.3	27.7	96.6	80.0	58.5
Douche, Other	43.9	39.5	33.7	87.8	73.7	60.7
Condom	37.2	34.3	22.8	78.7	75.3	59.1
Diaphragm and Jelly	14.3	2.9	2.3	26.8	20.3	4.7
Condom and Water Douche	47.6	41.9	28.6	85.7	64.5	53.6
Condom or Douche	73.9	52.4	25.0	91.3	78.4	41.7

Table 10. Interval in which wives first heard of method, for "relatively fecund" couples ever using selected methods, by income.³

¹ See Table 5, footnotes 2-9. See also Table 9, footnotes 4 and 5.

² In this table douching "for cleanliness only" is not considered contraception.

³ Excludes those wives who reported the time of first information as unknown.

seminated, may be considered as important antecedents to the subsequent degree of the effectiveness of contraceptive practice. Attention in this section, therefore, will be focused upon these sociological factors as well as upon the psychological complexities attending the preferences for and dissatisfactions with particular methods.⁴⁰

The period of life in which wives first learned of the contraceptive method which they later used is of obvious significance for the question of effectiveness of practice. If information about the more effective techniques is late in arrival it probably means that more unplanned pregnancies will occur than would have otherwise.⁴¹ The data about time of learning which are presented in Table 9 and in some of the subsequent tables suffer definite limitations. In the first place, the data were collected and coded for interpregnancy intervals which means,

⁴⁰ In most of the tables that follow, data for the "relatively fecund" and "relatively sterile" couples have been presented together and referred to as "all couples." Before reaching this decision, however, the two sets of data were analyzed independently and compared. With a few minor exceptions which will be mentioned, there are no significant differences between the two.

⁴¹ For an analysis of this relationship from the point of view of fertility-planning status, see Whelpton and Kiser, *op. cit.* vi. The Planning of Fertility, pp. 92-94 (Reprint pp. 238-240).

Between First and
Second Pregnancies

High	Medium	Low
100.0	95.9	90.3
100.0	93.8	91.4
96.6	100.0	85.1
95.1	89.5	80.9
90.4	90.4	78.7
44.6	52.2	20.9
100.0	96.8	71.4
100.0	97.3	95.8

for example, that the childless couples who learned about a method relatively late in married life are restricted to the "from marriage to first pregnancy" category. The categories for couples with one or two pregnancies are also restricted in a similar manner. The primary purpose in organizing these data in this manner was, of course, to show the influence of each pregnancy on the acquisition of contraceptive information. Secondly, these tables do not include all of the couples who know about methods A, B, etc., but only about those

who use these methods.⁴²

Because of these rather serious restrictions of the data, only a few remarks can be made. It is apparent that the wives of those couples using douches, condom, or safe period, first heard about the method comparatively early, averaging over 30 per cent before marriage. Conversely, less than 10 per cent of the wives of those couples employing diaphragm and jelly, jelly alone or suppository, first heard about these methods at this early period. In fact, 60 per cent of those using diaphragm and jelly did not learn of this method until sometime after their second pregnancy.

The data in Table 9 show unmistakably that the experience of the first pregnancy, as well as marriage itself, exerted a significant influence on the acquisition of first information about the various methods. Although more than half of the wives had learned about most of the methods they used before the first pregnancy, a significant proportion obtained their first information after the first conception but before the second.

To a considerable extent, the time at which the wife first heard about contraception is a function of economic status. An attempt has been made in Table 10 to evaluate this influence by controlling the factor of class differentials in the use

⁴² These limitations apply equally to Tables 10-12.

Table 11. Interval in which method was first used, for all couples ever using the method.¹

METHOD OF CONTRACEPTION ^a	NUMBER EVER USING METHOD	WHEN FIRST USED METHOD (CUMULATIVE PERCENTAGES) ^b			
		At (or Before) Marriage	After Marriage But Before First Pregnancy ^c	Between First and Second Pregnancies	Between Second and Third Pregnancies
ALL CONTRACEPTION	1,764		71.7 ^d	92.2	97.4
Douche, Water	216	45.8	63.4	83.8	93.1
Douche, Lysol	240	56.3	62.6	84.7	92.6
Douche, Salt and/or Soda	91	39.6	46.2	75.9	93.5
Douche, Zosite	58	69.0	79.3	86.2	96.5
Douche, Other	287	51.9	60.6	78.7	90.5
Condom	497	46.7	51.5	76.4	90.7
Withdrawal	110	31.8	34.5	65.4	86.3
Diaphragm and Jelly	235	7.2	10.2	31.9	62.1
Suppository	145	29.0	34.5	70.4	83.5
Jelly	43	0.0	4.7	58.2	74.5
Safe Period	40	30.0	30.0	67.5	95.0
Condom and Water Douche	98	31.6	34.7	64.3	76.5
Condom and Lysol Douche	44	22.7	27.2	74.9	84.0
Condom and Other Douche	81	44.4	44.4	77.7	92.5
Withdrawal and Douche	55	23.6	25.4	61.8	78.2
Diaphragm, Jelly, and Douche	26	0.0	3.8	19.2	57.7
Suppository and Douche	77	40.3	48.1	68.9	80.6
Safe Period and Douche	23	8.7	34.8	65.2	91.3
Condom or Douche	134	33.6	36.6	69.4	94.0
Condom or Douche, or Condom and Douche	75	38.7	38.7	68.0	92.0
Condom or Withdrawal	67	35.8	43.3	86.6	97.0
Withdrawal or Douche, or Withdrawal and Douche	55	41.8	41.8	70.9	83.6

¹ See Table 5, footnotes 2-9.^a In this table douching "for cleanliness only" is not considered contraception.^b Wives who had n pregnancies and first used the method after the n th pregnancy are shown as having used it between the n th and $n+1$ pregnancies.^c Includes wives who reported first using the method "at (or before) marriage."^d The punch card series from which the data on "all contraception" were taken does not permit the separation of these first two categories.

of the different methods. Complete income comparisons can be made only for seven methods which are used by a sufficient number of couples⁴³ in each income group to permit statistical manipulation. For virtually every comparison it is evident that a higher income status is associated with an early acquisition of information about contraception.

The pattern for period of first use of the different methods is quite similar to that for period of first information (*see* Table 11). The simpler techniques of douche and condom appear very early in use, and the comparatively complicated technique of diaphragm and jelly appears last. Only 7 per cent of the couples ever using this method began to do so "at marriage" and only 62 per cent had begun before the third pregnancy. This delay in the use of one of the most potentially effective of all contraceptives is probably due mainly to the fact that couples who had been unsuccessful in controlling their fertility decided eventually to seek professional advice from physicians and clinics who recommended diaphragm and jelly. The fact that the fitting of a diaphragm requires medical service certainly retards its adoption. Other factors that may have operated at the time of marriage for these couples (1927-1929) are the expense involved, the feeling that the method was complicated, and especially, as alluded to above, the comparative ignorance of the existence of this method.

For each of the methods used, there is definite evidence that economic status plays an important role in the time of its adoption (*see* Table 12) as well as in the time when the information about it was first obtained. In both cases the relation is positive.

More direct evidence about the order of use of the different methods is contained in Table 13. Douches and condom tend to be used first and diaphragm and jelly to be adopted only after previous experimentation with other techniques (43 per cent of the couples reporting the latter method had tried at least two others previously). Comparison of the proportions

⁴³ The minimum number was defined arbitrarily as twenty couples.

METHOD OF CONTRACEPTION*	WHEN FIRST USED METHOD (CUMULATIVE PERCENTAGES)					
	At (or Before) Marriage			After Marriage but Before First Pregnancy		
	Income of Couple					
	High	Medium	Low	High	Medium	Low
ALL CONTRACEPTION	*	*	*	87.7	73.6	56.7
Douche, Water	58.8	42.1	37.9	100.0	87.7	65.2
Douche, Lysol	96.6	51.9	38.9	96.6	87.0	75.8
Douche, Other	82.9	56.4	42.7	95.1	87.2	67.7
Condom	52.1	43.8	37.7	84.4	74.7	60.9
Diaphragm and Jelly	12.3	11.0	0.0	36.8	43.8	14.6
Condom and Water Douche	50.0	31.4	12.9	72.7	80.0	35.5
Condom or Douche	39.3	43.9	12.5	92.9	70.7	51.8

Table 12. Interval in which method was first used for "relatively fecund" couples ever using selected methods, by income.¹

* See Table 11, footnote 5.

¹ See Table 5, footnotes 2-9. See also Table 11, footnotes 3 and 4.

² In this table douching "for cleanliness only" is not considered contraception.

using a method first with those using it as the last method before the interview, which represents a crude index of satisfaction or acceptability of a method, reveals marked reductions in the various douches used alone and in the safe period, and marked increases in diaphragm and jelly and some of the combined techniques. The over-all proportion of "all couples" whose last method differs from their first is 45 per cent.⁴⁴

In a society in which the subject of contraception is to a great extent a very personal and intimate matter, the question of how the married woman or wife-to-be acquires her first information about various methods is of especial interest. Whether the channels of communication through which this type of information is disseminated are also of importance to the question of successful fertility planning depends on the degree to which the different sources of information are associated with methods of low or high effectiveness. In this discussion Tables 14 and 15 can be considered jointly since they present essentially the same relationships.⁴⁵

⁴⁴ This material is treated more extensively in the last section of this paper.

⁴⁵ The only difference of any significance between the two is the greater representation of the same methods in the two (Continued on page 323)

Between First and Second Pregnancies

High	Medium	Low
96.9	93.6	87.6
100.0	96.5	81.8
96.6	90.9	89.5
100.0	94.9	82.3
96.9	93.8	76.8
77.2	75.3	38.2
86.4	97.1	45.2
100.0	92.7	91.1

The four chief sources of information for virtually all the methods of contraception are the husband, friend, relative, and doctor. The importance of any one of these four sources, however, varies significantly among the different methods. Generally speaking, the wife who uses douches or safe period by themselves obtains her information from relatives and friends. The husband is the main source of information about the male contraceptives of condom, withdrawal, and related techniques, and the doctor is cited as the chief informant

about the more complicated methods as, for example, diaphragm and jelly. Printed material is more important for Zonite douche and jelly than for other methods but even for these two it ranks third. Of particular interest in these data is the almost completely insignificant role played by the druggist and clinic as sources of contraceptive information. The druggist is of some importance to the wife⁴⁶ only for the communication of information about jelly and the clinic only for diaphragm and jelly.

Income comparisons reveal only two significant differences in sources of information that are not a function of the differences in types of contraceptives most frequently used in the different classes. These exceptions are the expected greater representation of the doctor as a source in the higher-income groups and the higher incidence of the clinic in the lower-income class.

sensation of the "doctor" as a source of most satisfactory information than as a source of first information.

Essentially the same pattern of relationships appears for the sources of information for the "relatively fecund" couples as for the "relatively sterile" couples with the exception of the fact that the "doctor" is a more frequently cited source for the latter. This undoubtedly reflects the closer and more frequent contacts with doctors that these couples were likely to have because of their reproductive complications.

⁴⁶ In all likelihood, the druggist is probably more important as a secondary source of information in conveying information to the husband who subsequently becomes the direct source of information for the wife.

Table 13. Order of first use among all methods, for all couples ever using the method.¹

METHOD OF CONTRACEPTION ²	NUMBER EVER USING METHOD	ORDER OF FIRST USE				LAST METHOD USED BEFORE INTERVIEW
		Total	First	Second	Third	Fourth to Eighth
Douche, Water	216	100.1	65.3	28.2	5.6	1.0
Douche, Lysol	240	100.0	78.8	17.9	2.1	1.2
Douche, Salt and/or Soda	91	100.0	61.5	25.3	8.8	4.4
Douche, Zonite	58	100.0	79.3	13.8	6.9	0.0
Douche, Other	287	100.0	72.8	20.6	5.2	1.4
Condom	497	100.0	63.8	26.6	7.2	2.4
Withdrawal	110	99.9	54.5	32.7	10.0	2.7
Diaphragm and Jelly	235	100.1	14.9	41.7	25.1	18.4
Suppository	145	100.0	53.8	29.7	11.7	4.8
Jelly	43	100.0	18.6	46.5	27.9	7.0
Safe Period	40	100.0	65.0	12.5	20.0	2.5
Condom and Water Douche	98	100.0	39.8	32.7	14.3	13.2
Condom and Lyod Douche	44	100.0	43.2	38.6	11.4	6.8
Condom and Other Douche	81	99.9	58.0	22.2	12.3	7.4
Withdrawal and Douche	55	100.0	30.9	38.2	14.5	16.4
Diaphragm, Jelly, and Douche	26	99.9	3.8	30.8	42.3	23.0
Suppository and Douche	77	100.0	53.2	27.3	15.6	3.9
Safe Period and Douche	23	99.9	8.7	73.9	13.0	4.3
Condom or Douche	134	100.0	44.0	36.6	16.4	3.0
Condom or Douche, or Condom and Douche	75	100.1	42.7	42.7	12.0	2.7
Condom or Withdrawal	67	100.0	62.7	35.8	1.5	0.0
Withdrawal or Douche, or Withdrawal and Douche	55	100.0	47.3	34.5	9.1	9.1
						46.3
						32.5
						45.1
						41.4
						55.7
						61.6
						59.1
						70.2
						44.8
						39.5
						27.5
						71.4
						65.9
						76.5
						70.9
						69.2
						32.5
						60.9
						32.8
						56.0
						50.7
						45.6

¹ See Table 5, footnotes 2-9.² In this table "douching for cleanliness only" is not considered contraception.

Table 14. Source of wife's first information about the method, for all couples ever using the method.¹

METHOD OF CONTRACEPTION ²	NUMBER EVER USING METHOD ³	SOURCE OF FIRST INFORMATION ⁴							
		Doctor	Husband	Relative	Friend	Printed Material	Druggist	Clinic	Other
ALL CONTRACEPTION	1,845	15.9	27.8	28.3	26.6	5.7	2.2	0.3	6.3
Douche, Water	199	16.6	6.5	46.2	26.1	6.0	0.0	0.0	4.0
Douche, Lysol	238	15.5	8.0	38.2	30.7	9.2	1.7	0.0	5.0
Douche, Salt and/or Soda	85	22.4	4.7	55.3	23.5	0.0	0.0	0.0	0.0
Douche, Zonite	58	5.2	12.1	27.6	31.0	20.7	0.0	0.0	6.9
Douche, Other	283	25.1	9.2	30.4	31.8	5.7	2.5	0.0	8.5
Condom	489	11.2	58.3	8.4	23.1	2.0	1.0	0.4	2.5
Withdrawal	106	5.7	76.4	4.7	14.2	4.7	0.0	0.0	0.0
Diaphragm and Jelly	235	54.0	2.1	8.5	16.2	2.6	7.2	18.3	3.8
Suppository	145	10.3	4.8	17.2	50.3	6.9	5.5	0.0	10.3
Jelly	43	44.2	4.7	4.7	25.6	14.0	25.6	0.0	0.0
Safe Period	38	5.3	2.6	28.9	44.7	7.9	0.0	0.0	18.4
Condom and Water Douche	96	20.8	35.4	27.1	26.0	9.4	1.0	0.0	2.1
Condom and Lysol Douche	44	25.0	45.5	38.6	20.5	6.8	2.3	0.0	6.8
Condom and Other Douche	80	28.8	60.0	20.0	13.8	8.7	6.3	0.0	5.0
Withdrawal and Douche	54	22.2	25.9	25.9	24.1	3.7	0.0	3.7	5.6
Diaphragm, Jelly, and Douche	26	34.6	15.4	23.1	19.2	7.7	11.5	11.5	0.0
Suppository and Douche	77	19.5	10.4	31.2	37.7	11.7	0.0	0.0	5.2
Safe Period and Douche	21	42.9	0.0	14.3	23.8	9.5	4.8	0.0	14.3
Condom or Douche	125	24.8	49.6	24.8	29.6	5.6	0.8	0.0	4.0
Condom or Douche, or Condom and Douche	72	9.7	38.9	25.0	41.7	6.9	6.9	0.0	0.0
Condom or Withdrawal	67	9.0	67.2	10.4	16.4	3.0	3.0	0.0	3.0
Withdrawal or Douche, or Withdrawal and Douche	55	20.0	58.2	27.3	30.9	5.5	0.0	0.0	7.3

¹ See Table 5, footnotes 2-9.² In this table douching "for cleanliness only" is not considered contraception.³ Excludes those wives who reported the source of first information as unknown.⁴ The percentages in the rows add to more than 100 per cent because of multiple codes necessitated by wives who reported two (or more) sources of information as first, e.g., doctor and husband.

Table 15. Source of wife's most satisfactory information about the method, for all couples ever using the method.¹

METHOD OF CONTRACEPTION ²	NUMBER EVER USING METHOD ³	SOURCE OF FIRST INFORMATION ⁴							
		Doctor	Husband	Relative	Friend	Printed Material	Druggist	Clinic	Other
Douche, Water	174	19.0	7.5	47.7	21.8	5.2	1.1	0.0	4.0
Douche, Lysol	231	14.7	10.0	35.5	29.0	8.7	0.0	0.0	3.5
Douche, Salt and/or Soda	79	27.8	10.1	46.8	19.0	0.0	0.0	0.0	1.3
Douche, Zonite	57	15.8	12.3	24.6	31.6	15.8	0.0	0.0	0.0
Douche, Other	267	29.6	8.2	29.2	27.3	3.7	2.6	0.0	7.9
Condom	463	18.8	60.0	8.9	12.1	1.7	0.6	0.4	1.3
Withdrawal	100	8.0	79.0	4.0	9.0	0.0	0.0	0.0	0.0
Diaphragm and Jelly	227	55.1	3.5	4.0	5.7	3.1	5.3	27.3	0.9
Suppository	141	12.8	6.4	17.7	45.4	4.3	7.1	0.0	8.5
Jelly	39	33.3	5.1	5.1	23.1	10.3	28.2	0.0	0.0
Safe Period	29	10.3	10.3	24.1	34.5	6.9	0.0	0.0	17.2
Condom and Water Douche	94	25.5	37.2	18.1	19.1	9.6	1.1	0.0	0.0
Condom and Lysol Douche	44	27.3	45.5	18.2	13.6	4.5	2.3	0.0	0.0
Condom and Other Douche	79	30.4	58.2	8.9	6.3	6.3	5.1	0.0	5.1
Withdrawal and Douche	52	19.2	59.6	23.1	17.3	3.8	0.0	3.8	1.9
Diaphragm, Jelly, and Douche	24	50.0	4.2	4.2	16.7	8.3	16.7	0.0	8.3
Suppository and Douche	67	23.9	9.0	29.9	25.4	11.9	0.0	0.0	6.0
Safe Period and Douche	20	50.0	0.0	15.0	20.0	15.0	5.0	0.0	10.0
Condom or Douche	119	26.9	40.3	21.0	21.8	4.2	0.8	0.0	0.0
Condom or Douche, or Condom and Douche	65	23.1	55.4	12.3	21.5	4.6	7.7	0.0	0.0
Condom or Withdrawal	67	7.5	59.7	10.4	16.4	3.0	3.0	0.0	3.0
Withdrawal or Douche, or Withdrawal and Douche	53	18.9	47.2	28.3	18.9	0.0	0.0	0.0	5.7

¹ See Table 5, footnotes 2-9. It was impossible to present data in this table for "all contraception" because the appropriate punch card series does not include this item for the "relatively sterile" couples.

² In this table douching "for cleanliness only" is not considered contraception.

³ Excludes those wives who reported the source of most satisfactory information as unknown.

⁴ The percentages in the rows add usually to more than 100 per cent because of multiple codes necessitated by wives who reported two (or more) sources of information as most satisfactory, e.g., doctor and husband.

The complex of subjective evaluations which constitute the rationale underlying the adoption, use, and change of a contraceptive method constitutes an important aspect of the subject of acceptability of method.⁴⁷ That acceptability and effectiveness are related empirically will be demonstrated in a later section. It is obvious, of course, that a method can be effective only if it is used, and that a method which is felt to be unduly expensive, inconvenient, irritating, or unreliable, will not be used regardless of how effective it might be theoretically. Thus, it is necessary in any study of this nature to take into account the so-called "human equation" or the personal, subjective variability of the individuals involved.

The reasons offered by the wife for using a particular method are presented in Table 16. They include all the reasons that were offered for (a) preferring this method at the time it was first used, and/or (b) returning to it after changing from it to another method. The table does not include reasons for continuing to use a method after a period of several months of uninterrupted use. Not all of the categories are reasons in a strictly logical sense, e.g., "recommended by relative, friend, etc." but, nevertheless, are presented here because they represent statements which occurred on an important number of schedules as the only reasons given.

By far the outstanding consideration for the use of a method is the feeling that it is "reliable." Although the proportions of couples stating this as a reason varies significantly among the methods, it appears as the most frequently cited reason for the use of every method except the douches used singly. Among this latter group the reason of "cleanliness and sanitation" appears of greater importance.⁴⁸ The fact that a par-

⁴⁷ In studies of clinical populations, acceptability has been measured in terms of length of use of the prescribed method, initiative in renewing supplies, reactions to the prescription, and reasons for discontinuance. See, for example, Chapter VI in Beebe, *op. cit.*, pp. 154-181.

⁴⁸ The more frequent citation of this reason is the only significant difference between the "relatively fecund" and "relatively sterile" couples with respect to reasons for using a method. As would be expected, the "relatively sterile" couples who used douches gave more consideration to this factor.

Table 16. Reasons given by wife for using a particular method rather than others, for all couples ever using the method.¹

METHOD OF CONTRACEPTION ²	NUMBER EVER USING METHOD ³	REASONS FOR USING METHOD ⁴										
		Cleanliness, Sanitation	Inexpensive	Convenient	Reliable	Does Not Interfere With Employment	Beneficial Not Irritating	Recommended By Relative, Friend, Fellow Worker, Or Druggist	Recommended By Doctor or Clinic	Husband's Choice	Only Method Known	Other ⁵
Douche, Water	206	26.7	4.4	2.4	24.8	2.4	9.7	6.8	5.3	1.0	25.7	15.0
Douche, Lysol	231	23.8	4.8	9.5	28.6	6.1	5.6	6.5	8.7	0.9	31.2	19.9
Douche, Salt and/or Soda	91	20.9	5.5	3.3	17.6	7.7	12.1	9.9	14.3	1.1	23.1	24.2
Douche, Zonite	58	32.8	3.4	0.0	20.7	5.2	13.8	10.3	3.4	0.0	22.4	24.1
Douche, Other	263	26.6	3.4	2.7	23.2	5.3	12.5	15.2	20.9	1.1	17.5	12.9
Condom	482	0.4	1.5	6.8	67.4	2.1	1.7	2.9	10.6	17.2	14.9	14.5
Withdrawal	105	0.0	7.6	11.4	36.2	12.4	10.5	1.9	1.9	29.5	20.0	19.0
Diaphragm and Jelly	233	0.0	1.3	7.7	68.7	19.3	4.7	3.9	61.4	0.9	4.3	9.4
Suppository	141	0.0	2.1	13.5	40.4	17.7	1.4	17.7	8.5	0.0	12.8	13.5
Jelly	39	0.0	0.0	15.4	56.4	30.8	7.7	5.1	38.5	0.0	5.1	10.3
Safe Period	35	0.0	2.9	22.9	37.1	0.0	8.6	11.4	5.7	0.0	25.7	22.9
Condom and Water Douche	96	15.6	2.1	6.3	67.7	5.2	3.1	0.0	8.3	4.2	20.8	11.5
Condom and Lysol Douche	44	27.3	4.5	4.5	86.3	0.0	0.0	2.3	18.2	4.5	13.6	11.4
Condom and Other Douche	79	17.7	2.5	5.1	81.0	0.0	6.3	0.0	17.7	5.1	12.7	15.2
Withdrawal and Douche	53	18.9	1.9	13.2	56.6	11.3	1.9	3.8	11.3	7.5	9.4	17.0
Diaphragm, Jelly, and Douche	26	3.8	0.0	0.0	88.5	23.1	11.5	0.0	30.8	0.0	0.0	0.0
Suppository and Douche	74	5.4	1.4	5.4	59.5	8.1	8.1	9.5	14.9	6.8	10.8	13.5
Safe Period and Douche	23	21.7	17.4	30.4	56.5	8.7	4.3	4.3	13.0	0.0	8.7	17.4
Condom or Douche	132	9.1	6.1	16.7	63.6	9.1	7.6	2.3	18.2	3.8	12.1	17.4
Condom or Douche, or Condom and Douche	71	16.9	1.4	4.2	74.6	5.6	2.8	2.8	8.5	14.1	9.9	8.5
Condom or Withdrawal	65	6.2	4.6	24.6	36.9	9.2	4.6	0.0	6.2	33.8	9.2	10.8
Withdrawal or Douche, or Withdrawal and Douche	53	20.8	13.2	13.2	50.9	13.2	0.0	1.9	3.8	9.4	11.3	26.4

¹ See Table 5, footnotes 2-9.² In this table douching "for cleanliness only" is not considered contraception.³ Excludes those wives not reporting the reason for use.⁴ Includes all the reasons given for preferring this method at the time it was first used, and/or for returning to it after changing from it to another method. Excludes reasons which were given for continuing it after a period of several months of uninterrupted use. Multiple reasons account for the percentages in the lines adding to more than 100 per cent.⁵ Includes the following reasons of comparatively minor importance: postpone rather than prevent conception; recommended by door-to-door salesman, in advertisement, in book, etc.; "best" or "most satisfactory" given as only reason; more modern; natural; experimenting; religious belief; not messy; wife wanted husband to "take responsibility;" changed to another method, then resumed this; and other specific reasons not listed.

ticular method was the only one known at the time of first adoption is of some significance also, particularly for the douche category again. This consideration makes more intelligible our previous observation that douches are adopted early in marriage.

In comparison with the reason of "reliability" other reasons are of only occasional subsidiary importance. The feeling that the method is used because it is inexpensive is of almost no significance whatsoever. "Convenience" as a reason for use is of slight importance and for only a few of the methods listed. Strangely enough, the feeling that a method "does not interfere with enjoyment" is of importance only for jelly, diaphragm and jelly, and a few other methods. Comparison of the percentages in this column with those under the same heading in Table 17 suggests that this is primarily a negative consideration. The wife's statement that the use of a method was due to her husband's choice is of secondary significance only and for the methods of withdrawal and condom.

In general, it may be concluded that the feeling that a method is "reliable" is without question the most important consideration attending the choice of a contraceptive method. Other reasons appear occasionally for certain methods but on the whole are relatively unimportant.

It might be expected on sociological grounds that some of these reasons would be more characteristic of one economic class than another. Nonetheless, an analysis of these relationships, holding constant the factor of method, uncovered a slight association for only one of the reasons, namely,⁴⁹ an inverse association of income with the citation of "reliability" as a reason. If this association is valid, it may occur because the need for a reliable method is felt more in the lower-income group which has experienced more unplanned pregnancies.

In Table 17 are presented all the reasons given by the wife for every change from one method to another, or for discontinuing the method for other reasons than a desire to have a

⁴⁹ These data are not presented here because of space limitations.

Table 17. Reasons given by wife for changing method, for all couples ever using and changing the method.¹

METHOD OF CONTRACEPTION ²	NUMBER EVER USING METHOD	REASONS FOR CHANGING METHOD ³						PER CENT WHO DID NOT CHANGE	PER CENT WHO DID CHANGE ⁴	Interferes With Enjoyment or Messy	Health	Doctor Recommended Change	Other ⁵
		Expensive	Inconvenient	Unreliable	Interferes With Enjoyment or Messy	Health	Doctor Recommended Change						
Douche, Water	216	1.0	11.8	95.1	2.0	2.0	8.8	3.9					
Douche, Lysol	240	0.6	6.5	67.7	1.9	12.9	16.1	9.0					
Douche, Salt and/or Soda	91	0.0	5.3	92.1	0.0	0.0	7.9	15.8					
Douche, Zonite	58	0.0	6.1	78.8	0.0	3.0	15.2	12.1					
Douche, Other	287	3.5	8.8	77.2	0.0	3.5	10.5	16.7					
Condom	497	11.5	9.9	31.3	41.8	3.8	12.6	19.2					
Withdrawal	110	0.0	0.0	44.4	40.0	13.3	6.7	8.9					
Diaphragm and Jelly	235	12.2	20.3	33.8	10.8	5.4	6.8	44.6					
Suppository	145	14.1	16.5	62.4	8.2	5.9	7.1	10.6					
Jelly	43	3.8	3.8	61.5	15.4	0.0	0.0	19.2					
Safe Period	40	0.0	3.7	81.5	0.0	0.0	3.7	11.1					
Condom and Water Douche	98	0.0	12.0	28.0	20.0	4.0	8.0	48.0					
Condom and Lysol Douche	44	*	*	*	*	*	*	*					
Condom and Other Douche	81	10.0	20.0	35.0	60.0	15.0	15.0	10.0					
Withdrawal and Douche	55	*	*	*	*	*	*	*					
Diaphragm, Jelly, and Douche	26	*	*	*	*	*	*	*					
Suppository and Douche	77	12.5	12.5	58.3	0.0	2.1	6.3	22.9					
Safe Period and Douche	23	*	*	*	*	*	*	*					
Condom or Douche	134	6.1	12.2	70.7	41.5	1.2	4.9	2.4					
Condom or Douche, or Condom and Douche	75	46.7	7.1	53.6	25.0	3.6	0.0	10.7					
Condom or Withdrawal	67	49.3	6.5	32.3	32.3	0.0	22.6	9.7					
Withdrawal or Douche, or Withdrawal and Douche	55	*	*	*	*	*	*	*					

* Percentages not computed where fewer than twenty couples changed method for known reasons.

¹ See Table 5, footnotes 2-9.² In this table douching "for cleanliness only" is not considered contraception.³ Includes those couples who changed for unknown reasons. The percentages computed for stated reasons, however, are exclusive of cases where the reason for change was not reported. The percentages usually add to more than 100 because the interviewers were instructed to record all reasons for change given by the respondents and frequently more than one reason was given.⁴ Includes reasons for every change from one method to another and for discontinuing the method and entering periods of noncontraceptive exposure, except in order to conceive.⁵ Includes such reasons but excludes blameworthy insignificant reasons as "causes irritation"; "materials used up"; "willing to use less reliable method"; "more modern methods available"; "wife wanted husband to take responsibility;" etc.

child. These reasons for change to some extent complement the reasons for using the method.⁵⁰ The feeling that a method was "unreliable" accounts for most of the changes to another method. The proportion of couples who discontinued a method for this stated reason ranges from 95 per cent for water douche to 31 per cent for condom. The feeling that the method "interferes with enjoyment or is messy" is an important consideration only in the methods of condom or withdrawal alone, or in combined or alternate methods involving either of these two techniques. It will be observed in Table 17 that the most frequently cited reasons for change from diaphragm and jelly appear under the category "Other." A breakdown of this group reveals that half of these couples changed to another method because the necessary materials were "used up." It is also of interest to note that the proportion of couples who gave "inconvenience" as the reason for change is higher for diaphragm and jelly than for any other method. "Health" and "expensiveness" are of only negligible importance as reasons for change. Change because of a doctor's recommendation is of some importance for some of the douches, condom, and condom or withdrawal.

Unfortunately, the fact that these percentages had to be computed on the basis of those couples who changed their method resulted in an insufficient number of cases to permit any reliable economic-status comparisons. It would be expected that the same pattern of association would emerge that resulted from the "reasons for using" analysis.

In summary, it appears that the degree to which a method evokes confidence on the part of the user is the overwhelming criterion for its use or change. When the method is first tried this is mainly subjective, based on information from various sources. Later on it becomes much more objective, based on personal success or failure in controlling reproduction. It would appear, thus, that only those couples who have used methods

⁵⁰ The coefficient of rank-order correlation for methods used because they were considered to be reliable and methods changed because they were felt to be unreliable is $-.70$.

METHOD OF CONTRACEPTION	FIRST PREG- NANCY	AFTER FIRST PREG- NANCY	ALL PREGNANCIES			
			Total	Income of Couple		
				High	Medium	Low
All Methods, Total	12	10	10	6	8	15
<i>Douches, All Kinds Used Singly</i>	<i>27</i>	<i>16</i>	<i>18</i>	<i>15</i>	<i>14</i>	<i>23</i>
Douche, Water	23	21	22	22	18	24
Douche, Lysol	28	18	21	*	17	24
Douche, Salt and/or Soda	27	14	17	*	4	36
Douche, Zonite	9	10	9	4	14	*
Douche, Other	18	13	15	13	13	17
Condom	5	5	5	4	5	6
Withdrawal	7	6	6	3	5	9
Diaphragm and Jelly	1	4	4	2	3	6
Suppository	12	15	15	*	9	22
Jelly	*	9	10	*	*	*
Safe Period	*	35	25	*	*	*
Condom and Water Douche	6	6	6	3	5	13
Condom and Lysol Douche	*	4	5	*	2	*
Condom and Other Douche	2	4	3	*	3	5
Withdrawal and Douche	*	6	5	*	*	6
Diaphragm, Jelly, and Douche	*	5	5	*	*	*
Suppository and Douche	8	16	14	*	8	37
Safe Period and Douche	*	*	6	*	*	*
Condom or Douche	11	13	12	4	10	19
Condom or Douche, or Condom and Douche	12	5	7	*	6	7
Condom or Withdrawal	1	8	6	*	*	13
Withdrawal or Douche, or Withdrawal and Douche	*	18	17	*	*	17

Table 18. Pregnancies per 100 years exposure with specified methods of contraception for exposure when contraception was practiced "always," for "relatively fecund" couples by income.¹

* Base less than twenty couples and/or 50 exposure-years.

¹ See Table 5, footnotes 2-9. See Appendix I for number of exposure-years on which rates were computed.

successfully can afford the luxury of considerations other than reliability.

THE EFFECTIVENESS OF THE DIFFERENT METHODS OF CONTRACEPTION

Any attempt to measure the effectiveness of a given method of contraception among a large group of people cannot deal with the method's theoretical or potential effectiveness but is restricted to its observed or actual effectiveness. Beebe has conceptualized this problem⁵¹ in terms of what he calls "physio-

⁵¹ *Op. cit.*, p. 101.

METHOD OF CONTRACEPTION	FIRST PREG- NANCY	AFTER FIRST PREG- NANCY	ALL PREGNANCIES			
			Total	Income of Couple		
				High	Medium	Low
All Methods, Total	103	124	118	186	151	80
<i>Douches, All Kinds Used Singly</i>	<i>56</i>	<i>74</i>	<i>67</i>	<i>80</i>	<i>86</i>	<i>53</i>
Douche, Water	53	57	55	56	65	50
Douche, Lysol	42	67	58	*	72	50
Douche, Salt and/or Soda	45	84	70	*	291	33
Douche, Zonite	136	122	129	295	88	*
Douche, Other	65	94	82	91	91	72
Condom	251	225	232	269	234	208
Withdrawal	174	205	196	452	240	138
Diaphragm and Jelly	1,264	295	322	557	472	185
Suppository	103	79	82	*	127	54
Jelly	*	141	126	*	*	*
Safe Period	*	34	49	*	*	*
Condom and Water Douche	210	190	194	375	260	92
Condom and Lysol Douche	*	278	248	*	615	*
Condom and Other Douche	805	278	371	*	436	264
Withdrawal and Douche	*	204	228	*	*	185
Diaphragm, Jelly, and Douche	*	242	251	*	*	*
Suppository and Douche	144	74	88	*	152	32
Safe Period and Douche	*	*	215	*	*	*
Condom or Douche	111	93	97	339	119	63
Condom or Douche, or Condom and Douche	99	233	175	*	195	170
Condom or Withdrawal	954	151	208	*	*	92
Withdrawal or Douche, or Withdrawal and Douche	*	67	72	*	*	70

Table 19. Mean number of exposure-months per conception with specified methods of contraception for exposure when contraception was practiced "always," for "relatively fecund" couples by income.¹

* Base less than twenty couples and/or 50 exposure-years.

¹ See Table 5, footnotes 2-9. See Appendix I for number of exposure-years on which averages were computed.

logical effectiveness," which assumes that the method is employed with perfect technique and regularity, as opposed to "use-effectiveness" which reflects variations resulting from relative differences in skill and regularity. The first concept implies that a conception which occurred could be attributed directly to the methods and materials themselves; the second concept relates only to the observed effectiveness which reflects the whole range of variation in use and motivation as well as purely mechanical failures. No statistical data have ever been collected which would measure pure physiological effectiveness

METHOD OF CONTRACEPTION	FIRST PREG-NANCY	AFTER FIRST PREG-NANCY	ALL PREGNANCIES			
			Total	Income of Couple		
				High	Medium	Low
All Methods, Total	15	11	12	8	10	18
<i>Douches, All Kinds Used Singly</i>	26	18	21	18	17	26
Douche, Water	30	23	25	23	23	27
Douche, Lysol	32	22	25	22	19	31
Douche, Salt and/or Soda	33	15	19	*	7	34
Douche, Zonite	19	12	16	11	18	*
Douche, Other	20	15	17	16	15	19
Condom	6	7	7	6	6	8
Withdrawal	9	10	10	3	12	13
Diaphragm and Jelly	1	4	4	3	3	7
Suppository	16	16	16	*	15	20
Jelly	*	10	11	*	*	*
Safe Period	*	38	26	*	*	*
Condom and Water Douche	8	7	8	5	5	15
Condom and Lysol Douche	*	5	6	*	3	*
Condom and Other Douche	2	5	3	*	3	5
Withdrawal and Douche	*	6	6	*	6	7
Diaphragm, Jelly, and Douche	*	8	8	*	*	*
Suppository and Douche	12	16	15	*	7	44
Safe Period and Douche	*	*	6	*	*	*
Condom or Douche	14	14	14	7	10	21
Condom or Douches or Condom and Douche	14	7	9	*	8	10
Condom or Withdrawal	3	10	8	*	*	16
Withdrawal or Douche, or Withdrawal and Douche	18	19	19	*	*	22

Table 20. Pregnancies per 100 years exposure with specified methods of contraception for exposure when contraception was practiced "always," "usually," or "sometimes," for "relatively fecund" couples by income.¹

* Base less than twenty couples and/or 50 exposure-years

¹ See Table 5, footnotes 2-9. See Appendix I for number of exposure-years on which rates were computed.

nor, from the perspective of social science, is this type of data absolutely necessary.⁵² It is desirable, however, to standardize the regularity of use, in so far as possible, in order to achieve some basis for the evaluation of a method. For this reason, in the data on effectiveness which follow, a distinction has been maintained between exposure during which time contraception was practiced "always" and exposure while the method was

⁵² Beebe argues that even the clinician's concept of effectiveness "is academic and unreal in the sense that perfect use cannot be assumed, and that the need is for a reliable estimate of the protection patients will derive from however they use a prescribed method." *Ibid.*, pp. 242-243.

METHOD OF CONTRACEPTION	FIRST PREG-NANCY	AFTER FIRST PREG-NANCY	ALL PREGNANCIES			
			Total	Income of Couple		
				High	Medium	Low
All Methods, Total	80	105	97	150	122	68
<i>Douches, All Kinds Used Singly</i>	46	65	57	67	70	46
Douche, Water	41	53	48	52	51	44
Douche, Lysol	37	55	48	54	62	39
Douche, Salt and/or Soda	36	82	63	*	169	35
Douche, Zonite	64	97	77	104	67	*
Douche, Other	59	79	71	73	79	63
Condom	185	175	177	207	199	143
Withdrawal	131	121	123	452	99	96
Diaphragm and Jelly	1,264	273	299	424	472	182
Suppository	75	76	76	*	81	59
Jelly	*	121	111	*	*	*
Safe Period	*	31	46	*	*	*
Condom and Water Douche	141	165	160	235	221	82
Condom and Lysol Douche	*	256	204	*	370	*
Condom and Other Douche	805	260	351	*	436	226
Withdrawal and Douche	*	189	214	*	203	185
Diaphragm, Jelly and, Douche	*	150	154	*	*	*
Suppository and Douche	102	75	82	*	163	27
Safe Period and Douche	*	*	189	*	*	*
Condom or Douche	83	84	84	180	124	56
Condom or Douche, or Condom and Douche	86	161	133	*	156	114
Condom or Withdrawal	389	116	149	*	*	74
Withdrawal or Douche, or Withdrawal and Douche	66	62	64	*	*	54

Table 21. Mean number of exposure-months per conception with specified methods of contraception for exposure when contraception was practiced "always," "usually," or "sometimes," for "relatively fecund" couples by income.¹

* Base less than twenty couples and/or 50 exposure-years.

¹ See Table 5, footnotes 2-9. See Appendix 1 for number of exposure-years on which averages were computed.

used only "usually" or "sometimes."⁸⁸ The pregnancy rates in Table 18 and the average number of exposure months per conception in Table 19 reflect the protection afforded by different methods of contraception when they are used with very few omissions; the data in Tables 20 and 21 manifest the decrease in effectiveness that accrues from the addition of irregularities in use and represents the results of the total contraceptive efforts of the "relatively fecund" couples.

An additional complication in evaluating method-effective-

⁸⁸ See second section for definitions.

ness is the fact that the experience of the same couples is not being compared.⁵⁴ It is impossible to separate completely the potential effectiveness of the method from the social and psychological factors that may differentiate the couples who use one method from those who use another. Differentiation on the basis of income class contributes a desirable but only a crude refinement.

The three most effective "single" methods of contraception, as evidenced by the rates and averages in Tables 18-21, are diaphragm and jelly, condom, and withdrawal. The least effective is "safe period" followed by the douches.⁵⁵ The combined and alternate methods are generally intermediate with the primary differentiation appearing to lie in the presence or absence of the condom as one of the component techniques. The combination of condom with "other douche," for example, results in a slight increase in protection over the use of condom alone. These general patterns of effectiveness hold true, with some minor exceptions, within the three income classes. Generally speaking, these data support previous findings of other research on the effectiveness of different methods, for example, that by Stix and Notestein,⁵⁶ and Beebe,⁵⁷ and reaffirm the position that the effectiveness of the condom argues well for its popularity and that of diaphragm and jelly for its prescription by clinics.⁵⁸

⁵⁴ This statement is not entirely true because there are many instances where couples have changed methods (see Tables 13 and 17). However, the essential objection to a lack of perfect comparability holds true.

⁵⁵ The differences between the rates for the methods of douche (all kinds used singly), condom, and diaphragm and jelly are statistically significant at the 1 per cent level with the exception of the differences between the first pregnancy rates for diaphragm and jelly, and condom, which is not significant. The difference between the rates for "all douches" and withdrawal is statistically significant at the 1 per cent level but the differences between withdrawal and condom and withdrawal and diaphragm and jelly are not significant except for the difference between first pregnancy rates for withdrawal and diaphragm and jelly which is significant at the 5 per cent level.

⁵⁶ *Op. cit.*, Chapters vi and x.

⁵⁷ *Op. cit.*, Chapters iv and v.

⁵⁸ *Ibid.*, pp. 193-194. See also Guttmacher, Alan F.; Tietze, Christopher; and Rubin, Samuel: *Contraception Among Two Thousand Obstetric Patients. The*

(Continued on page 337)

A summary of the contraceptive experience of the total group of couples studied, i.e., the "relatively fecund" and "relatively sterile" couples⁵⁹ combined, is presented in Tables 22 and 23. In a tabulation of these data, contraceptive exposure with and without lactation is separated for the total period after the first pregnancy. The pregnancy rate for all contraceptive exposure with lactation is 7 (this rate not shown in Table 22)⁶⁰ as compared with a rate of 10 for all contraceptive exposure without lactation.⁶¹ The difference, although not great,⁶² indicates some reduction in the risk of conception during the period following parturition.⁶³

The comparative effectiveness of the different contraceptive methods, viewed in conjunction with the previous analysis of the differential use of these methods by the three income classes (*see* Tables 5-8) confirms the hypothesis that the less effective techniques are used more by lower-income than by higher-income couples. Another aspect of this relationship which can be examined now is the question of the relationship between proficiency of use and economic status. In other words, is there a systematic difference in the successful appli-

Journal of the American Medical Association, August, 1949, 140, pp. 1265-1268; Cautley, Randolph and Beebe, Gilbert W.: *The Condom in Modern Contraceptive Practice: A Report from the National Committee on Maternal Health, Inc.*, New York. *Marriage Hygiene*, August, 1936, 3, No. 1, pp. 8-22, continued in November, 1936, 3, No. 2, pp. 154-164.

⁵⁹ Pregnancy rates for the different methods for the "relatively sterile" couples are not presented separately because the comparatively small amount of contraceptive exposure of this group permitted rates to be computed only for a few methods. In the few instances where comparisons were possible there was evident no significant departure from the pattern established by the "relatively fecund" couples.

⁶⁰ The rates and averages in Tables 22 and 23 show only the differences in the risk to conception when lactation is excluded in the total contraceptive exposure after the first pregnancy. The rate of 7 (*see* above) is based on the number of conceptions occurring during months of lactation only, when contraception was practiced.

⁶¹ These rates are for exposure when contraception was practiced "always." The rates are 8 and 11, respectively, for all regularities combined.

⁶² The difference between these two rates is significant at the 1 per cent level of probability.

⁶³ It is unwise to place too much confidence in these rates for periods with lactation. A difference of as little as one month in the memory of the respondent would affect seriously the value of the rate if a conception occurred during this month. There is a definite possibility of this happening because the conception would be likely to occur probably toward the end of the lactation period.

Table 22. Pregnancies per 100 years exposure with specified methods of contraception used "always," and "always," "usually," or "sometimes," for exposure before and after first pregnancy, and after first pregnancy excluding lactation, for all couples.¹

METHOD OF CONTRACEPTION	BEFORE FIRST PREGNANCY		AFTER FIRST PREGNANCY				ALL PREGNANCIES	
	Used "Always"	Used "Always," "Usually," or "Sometimes"	Used "Always"		Used "Always," "Usually," or "Sometimes"		Used "Always"	Used "Always," "Usually," or "Sometimes"
			Total	Excluding Lactation	Total	Excluding Lactation		
All Methods, Total	11	14	9	10	11	11	10	12
Douches, All Kinds Used Singly	20	29	15	15	17	17	16	19
Douches, Water	18	23	19	19	20	20	19	21
Douches, Lysol	29	34	18	19	22	23	21	26
Douches, Salt and/or Soda	20	23	13	13	14	14	15	17
Douches, Zonite	9	16	11	11	13	13	9	15
Douches, Other	19	18	11	11	12	13	13	15
Condom	4	6	5	5	7	8	5	7
Withdrawal	7	8	6	5	12	11	6	11
Diaphragm and Jelly	1	1	5	5	5	5	4	4
Suppository	12	15	14	15	14	15	14	14
Jelly	•	•	9	9	8	9	10	9
Safe Period	•	•	29	34	27	29	22	21
Condom and Water Douche	5	7	6	7	7	7	6	7
Condom and Lysol Douche	•	•	4	5	5	5	5	6
Condom and Other Douche	2	1	4	4	4	4	3	3
Withdrawal and Douche	•	•	6	6	6	7	5	6
Diaphragm, Jelly, and Douche	•	•	5	5	8	7	5	8
Suppository and Douche	9	11	16	15	15	14	13	14
Safe Period and Douche	•	•	•	•	•	•	6	6
Condom or Douche	9	10	13	14	14	15	12	13
Condom or Douche, or Condom and Douche	12	14	5	6	7	8	7	9
Condom or Withdrawal	1	3	8	9	10	11	6	8
Withdrawal or Douche, or Withdrawal and Douche	14	18	20	22	21	23	19	20

* Base less than twenty couples and/or 50 exposure-years.

¹ See Table 5, footnotes 3-9. "All couples" relates to "relatively fecund" and "relatively sterile" couples combined. See Appendix I for number of exposure-years on which rates were computed.

Table 23. Mean number of exposure-months with specified methods of contraception used "always," and "always," "usually," and "sometimes," for exposure before and after first pregnancy and after first pregnancy excluding lactation, for all couples.¹

METHOD OF CONTRACEPTION	BEFORE FIRST PREGNANCY		AFTER FIRST PREGNANCY				ALL PREGNANCIES	
	Used "Always"	Used "Always," "Usually," or "Sometimes"	Used "Always"		Used "Always," "Usually," or "Sometimes"		Used "Always"	Used "Always," "Usually," or "Sometimes"
			Total	Excluding Lactation	Total	Excluding Lactation		
All Methods, Total	107	84	129	126	108	105	122	100
<i>Dothers, All Kinds Used Singly</i>	61	53	82	80	72	70	73	63
Douche, Water	66	51	64	63	60	59	64	56
Douche, Lysol	41	35	66	64	54	51	56	46
Douche, Salt and/or Soda	59	53	92	94	86	86	79	72
Douche, Zonite	142	75	113	112	92	91	128	82
Douche, Other	65	65	113	107	97	93	91	82
Condom	280	189	237	233	162	159	247	169
Withdrawal	184	145	216	232	103	105	207	111
Diaphragm and Jelly	1,312	1,312	261	255	245	239	286	269
Suppository	102	79	86	82	84	79	88	83
Jelly	•	•	141	135	143	136	126	131
Safe Period	•	•	41	36	45	41	55	56
Condom and Water Douche	252	169	193	183	168	164	204	169
Condom and Lysol Douche	•	•	278	257	256	237	248	192
Condom and Other Douche	805	822	322	305	301	285	407	388
Withdrawal and Douche	•	•	199	198	187	184	223	212
Diaphragm, Jelly, and Douche	•	•	242	237	150	164	251	154
Suppository and Douche	138	105	76	81	79	83	91	86
Safe Period and Douche	•	•	•	•	•	•	219	192
Condom or Douche	137	116	93	87	84	78	102	91
Condom or Douche, or Condom and Douche	96	87	223	211	161	149	162	130
Condom or Withdrawal	954	389	154	139	118	107	211	151
Withdrawal or Douche, or Withdrawal and Douche	86	66	59	55	57	53	64	59

¹ Base less than twenty couples and/or 50 exposure-years.

² See Table 5, footnotes 1-9. "All couples" relates to "relatively fecund" and "relatively sterile" couples combined. See Appendix I for number of exposure-years on which averages were computed.

cation of a method among the income classes which is independent of the particular method? The data in Tables 18 to 21 suggest definitely that this is true. For each of the methods used for which comparisons are possible, couples in the "low" income group manifest a higher pregnancy rate than those in the "medium" or "high" income groups. In general, an overall inverse association can be observed.⁶⁴ Stated differently, the fact is that even the most effective methods are used with greater success by high-income couples than by couples lower in the income hierarchy. This relationship is more pronounced for the experience before the first pregnancy than for that following this event. (These detailed data are not presented here because of space limitations.) This difference may be due partly to the fact that couples in the low-income class start to use contraception later in marriage and thus gain proficiency at a later time. An additional consideration, of equal if not greater importance, is the probability of increased determination on the part of couples in this group to control their fertility. This whole relationship⁶⁵ reflects differences of proficiency of use when contraception is practiced "always." The pregnancy rates for "all methods"⁶⁶ when contraception was practiced "usually" or "sometimes" are 45, 37, and 48 for the "high," "medium," and "low" income groups, respectively (*see* Table 3), and do not evidence an inverse relationship.

In any study of the effectiveness of contraception there is a

⁶⁴ Chi squares were computed to test the statistical significance of the differences between the rates for each method (where at least two rates were computed) among the three income classes (rates in Table 18). The rates for the income classes differ at the 1 per cent level of significance for the following methods which were examined: douches, all kinds used singly, condom, suppository, "condom and water douche," "suppository and douche," "condom or douche," between the 1 per cent and 2 per cent level for diaphragm and jelly; and were found to be "not significant" ($P > .05$) for withdrawal, "condom and other douche," and "condom or douche, or condom and douche."

⁶⁵ The social and psychological origins of this relationship which stem probably from class differences in education, differential sensitivities to "middle-class" values which are manifested in varying degrees of intensity of motivation to restrict size of family, and other factors of this nature, are not the subject of this present analysis. Some of these broader questions are dealt with at length in other reports in the Indianapolis Study.

⁶⁶ There is an insufficient amount of this exposure to permit the computation of rates for individual methods.

need for some quantitative measure of the proportionate decrease in the risk of conception which is afforded by the use of a given method. The conventional yardstick which has been developed usually has been referred to as the "effectiveness ratio," and represents the proportion of expected pregnancies that were prevented.⁶⁷ The short method of calculating this ratio, used by Beebe, is simply to subtract the pregnancy rate with a specific method from the pregnancy rate without contraception, divide by the latter factor, and multiply by 100.⁶⁸ The result may then be expressed as the percentage of pregnancies prevented by the use of contraception, or the percentage reduction in risk from the level expected if no contraception were used.

This entire concept of the effectiveness ratio is open to serious criticism for both theoretical and practical reasons. Some of the more important criticisms are briefly enumerated in Appendix II. Two basic problems, however, should be mentioned at this point. The first relates to the type of noncontraceptive experience which is selected as a standard. The alternatives are (a) exposure before the first use of contraception; (b) exposure following the interruption of contraception in order to conceive; or (c) all noncontraceptive exposure, i.e., both (a) and (b).⁶⁹ The alternatives competing seriously for attention are (a) and (c); for reasons given in Appendix II, alternative (a) was selected. The second problem is less serious. Because each of the methods reduced the risk greatly, the effectiveness ratios have been subtracted from 100 per cent and

⁶⁷ The method of computing this ratio is described and illustrated in Stix and Notestein, *op. cit.*, pp. 58-59 and p. 182. The shorter method used by Beebe, which is referred to here, is described along with a theoretical consideration of the concept in Beebe, *op. cit.*, pp. 239-242.

⁶⁸ For example, if the noncontraceptive pregnancy rate were 200 and the rate with contraception were 20, then the per cent protection gained by the use of contraception would be $200 - 20$ divided by 200, or 90 per cent. The statistical difference between the measurement used by Stix and Notestein and by Beebe is that the former method introduces a standardization procedure to neutralize differences in age or duration of marriage. The Indianapolis data present no serious complications of this nature.

⁶⁹ More accurately, "all noncontraceptive exposure" includes also exposure following the interruption of contraception for purposes other than conception. This exposure is negligible, however. (See Table 1.)

are presented as *ineffectiveness* ratios, except in the summary in Table 26 where, for purposes of comparability with other studies, the original effectiveness ratios are shown. The desirability of this kind of manipulation can be appreciated from the following example. The first pregnancy rates for water douche and condom are 23 and 5, respectively (Table 18). The corresponding effectiveness ratios are 88 per cent and 98 per cent. The relative difference is much greater for the rates than it is for the ratios. Transforming the latter into *ineffectiveness* ratios of 12 per cent and 2 per cent restores a large relative

Table 24. Ineffectiveness ratios: the proportion of "expected" pregnancies not prevented by the use of specified methods of contraception, for "relatively fecund" couples by income, for exposure when contraception was practiced "always."¹

METHOD OF CONTRACEPTION	FIRST PREG-NANCY	AFTER FIRST PREG-NANCY	ALL PREGNANCIES			
			Total	Income of Couple		
				High	Medium	Low
All Methods, Total	5.9	9.6	8.1	4.6	6.2	13.2
Douches, All Kinds Used Singly	10.0	16.0	13.5	0.4	10.6	19.0
Douche, Water	11.7	20.8	16.2	13.1	14.2	19.2
Douche, Lysol	14.5	17.6	16.3	*	12.6	20.3
Douche, Salt and/or Soda	13.7	14.1	13.9	*	3.3	31.6
Douche, Zonite	4.5	9.7	6.2	2.5	9.4	*
Douche, Other	9.4	12.7	11.1	8.1	9.9	14.0
Condom	2.4	5.3	4.1	3.2	4.1	5.1
Withdrawal	3.5	5.8	4.9	1.8	4.1	7.8
Diaphragm and Jelly	0.5	4.0	3.3	1.8	2.2	6.4
Suppository	6.0	14.9	12.7	*	7.9	19.1
Jelly	*	8.5	9.1	*	*	*
Safe Period	*	35.2	16.7	*	*	*
Condom and Water Douche	2.9	6.2	5.1	2.4	3.8	12.6
Condom and Lysol Douche	*	4.3	4.5	*	1.9	*
Condom and Other Douche	0.8	4.3	2.4	*	2.0	4.0
Withdrawal and Douche	*	5.8	4.1	*	*	5.0
Diaphragm, Jelly, and Douche	*	4.9	4.6	*	*	*
Suppository and Douche	4.3	16.0	10.3	*	5.9	35.5
Safe Period and Douche	*	*	4.7	*	*	*
Condom or Douche	5.6	12.7	10.1	2.6	7.5	18.1
Condom or Douche, or Condom and Douche	6.2	5.1	5.5	*	5.3	5.8
Condom or Withdrawal	0.6	7.9	4.4	*	*	12.7
Withdrawal or Douche, or Withdrawal and Douche	*	17.7	13.0	*	*	16.5

* Base less than twenty couples and/or 50 exposure-years.

¹ See Table 5, footnotes 2-9.

difference like that of the rates. The interpretation remains absolutely the same; only the appearance changes.

The ratios in Tables 24-25 show conclusively that almost all methods of contraception are highly effective for "relatively fecund" couples *from a demographic point of view*. If these couples used one of the least effective methods "always"—the water douche—they would have only 12 of every 100 pregnancies that would occur if no contraception were practiced. Nevertheless, there are differences in effectiveness among the various methods which are highly important from a "personal"

Table 25. Ineffectiveness ratios: the proportion of "expected" pregnancies not prevented by the use of specified methods of contraception, for "relatively fecund" couples by income, for exposure when contraception was practiced "always," "usually," or "sometimes."¹

METHOD OF CONTRACEPTION	FIRST PREGNANCY	AFTER FIRST PREGNANCY	ALL PREGNANCIES			
			Total	Income of Couple		
				High	Medium	Low
All Methods, Total	7.7	11.3	9.8	5.7	7.7	15.5
<i>Douches, All Kinds Used Singly</i>	<i>13.4</i>	<i>18.3</i>	<i>15.8</i>	<i>11.2</i>	<i>12.8</i>	<i>21.6</i>
Douche, Water	15.1	22.4	18.5	13.8	17.7	21.5
Douche, Lysol	16.5	21.7	19.4	15.3	14.3	25.8
Douche, Salt and/or Soda	16.9	14.5	15.4	*	5.7	30.2
Douche, Zonite	9.6	12.2	10.5	7.1	12.6	*
Douche, Other	10.3	15.1	12.7	10.1	11.2	15.6
Condom	3.3	6.8	5.4	4.2	4.7	7.4
Withdrawal	4.7	9.8	7.8	1.8	9.9	11.3
Diaphragm and Jelly	0.5	4.3	3.6	2.4	2.2	6.5
Suppository	8.2	15.6	13.8	*	12.3	17.7
Jelly	*	9.8	10.3	*	*	*
Safe Period	*	37.5	17.7	*	*	*
Condom and Water Douche	4.3	7.2	6.2	3.8	4.5	14.1
Condom and Lysol Douche	*	4.6	5.5	*	3.1	*
Condom and Other Douche	0.8	4.6	2.5	*	2.0	4.6
Withdrawal and Douche	*	6.3	4.4	*	4.6	5.0
Diaphragm, Jelly, and Douche	*	7.9	7.5	*	*	*
Suppository and Douche	6.0	15.8	11.4	*	5.7	41.2
Safe Period and Douche	*	*	5.4	*	*	*
Condom or Douche	7.4	14.2	11.9	4.9	7.3	20.6
Condom or Douche, or Condom and Douche	7.1	7.4	7.3	*	6.6	8.7
Condom or Withdrawal	1.6	10.2	6.2	*	*	15.8
Withdrawal or Douche, or Withdrawal and Douche	9.3	19.0	14.2	*	*	20.9

* Base less than twenty couples and/or 50 exposure-years.

¹ See Table 5, footnotes 2-9.

	NUMBER OF PREGNANCIES EXPECTED ¹	NUMBER OF PREGNANCIES OBSERVED	EFFECTIVENESS RATIO ²
	WHEN CONTRACEPTION USED "ALWAYS"		
'Relatively Fecund'	14,906	1,207	91.9
"All Couples"	15,106	1,295	91.4
	WHEN CONTRACEPTION USED "ALWAYS," "USUALLY," OR "SOMETIMES"		
"Relatively Fecund"	15,985	1,567	90.2
"All Couples"	16,253	1,738	89.3

Table 26. Effectiveness ratios: the proportion of "expected" pregnancies prevented by the use of contraception, for "relatively fecund" couples and for all couples according to regularity of contraceptive practice.

¹ The number of exposure-years with contraception before the first pregnancy, multiplied by the first-pregnancy rate without contraception, divided by 100, plus the number of exposure-years with contraception after the first pregnancy, multiplied by the later-pregnancy rate without contraception, divided by 100.

² The number of pregnancies expected, minus the number of pregnancies observed, divided by the number of pregnancies expected, multiplied by 100.

point of view.⁷⁰ For example, the average married woman practicing contraception regularly during a reproductive period of around 25 years would experience four or five unplanned pregnancies if the method were water douche but a maximum of only one if it were diaphragm and jelly.⁷¹ The rank order of the effectiveness of the various methods according to these ratios follows the pattern that has been observed above in the discussion of pregnancy rates. Table 24 presents the relative lack of protection afforded all "relatively fecund" couples by the use of the various methods "always"; Table 25 shows the net "inadequacies" of the different methods as actually used by the group.⁷²

A condensed summary of the effectiveness of all contracep-

⁷⁰ For a similar criticism of this shortcoming of the conventional measure of effectiveness, see Tietze, Christopher; Guttmacher, Alan F.; and Rubin, Samuel: Time Required For Conception in 1,727 Planned Pregnancies. *Fertility and Sterility*, July, 1950, 1, No. 4, p. 341.

⁷¹ Allowance has been made for gestation, puerperium, and lactation. The estimate, nevertheless, is crude and should be regarded only as an illustration of the point in question.

⁷² The rank order of methods ranked according to effectiveness is essentially the same for the "relatively fecund" couples as for "all couples," the coefficient of correlation being +.99.

tion for the Indianapolis couples classified according to fecundity and regularity status is shown in Table 26 where the original effectiveness ratios are reproduced. The bottom section of this table shows the effectiveness of all methods of contraception as practiced in the population.

THE INTERRELATION OF EFFECTIVENESS AND ACCEPTABILITY

As stated in a previous section,⁷³ a contraceptive method is effective *only if it is used*; the factors that govern its use or non-use may be theoretically quite diverse in nature. For all intents and purposes, however, it is clear that the chief consideration in using a particular method, rather than another, was the feeling on the part of the couple that the method was reliable. On the basis of this information, a high, positive correlation should be expected between methods used because they are "reliable" and the actual or observed effectiveness of these methods. The coefficient of correlation obtained is +.66.⁷⁴ Additional evidence to support this relationship is the coefficient of -.85 between methods which were abandoned because they were felt to be "unreliable" and the observed effectiveness of these methods.

With an empirical profile of the effectiveness of the various methods it is now possible to examine more closely the extent to which couples tend to gravitate, over a period of years, from

⁷³ See discussion of reasons for use and change of method.

⁷⁴ This coefficient, and those which follow in this discussion, were obtained by the rank-order correlation technique. The twenty-two methods were ranked in accord with (in this instance) the proportion of "all couples" ever using the method who used it because they felt it was reliable and the rank-order effectiveness of these methods based on the effectiveness ratios of the various methods for all pregnancies, as used by "all couples" ever using contraception who used it "always," "usually," or "sometimes." Before the method of rank-order correlation was finally adopted, some experimentation was done with other alternative techniques, for example, the conventional product-moment formula used with the actual values of the percentages and, where applicable, based upon the transformation of percentages to angles according to the angular transformation table reproduced in Snedecor, George W.: *STATISTICAL METHODS*. Ames, Iowa, The Iowa State College Press, Fourth Printing, 1950, pp. 449-450. The results of these various procedures produced only negligible changes in the values of the coefficients (slightly higher than those resulting from the rank-order method) which were not considered sufficiently different to warrant their presentation.

Confidence in these coefficients requires a coefficient of at least .42 at the 5 per cent level of significance and at least .54 at the 1 per cent level. *Ibid.*, p. 149.

EFFECTIVENESS ⁴ OF METHODS USED FIRST	NUMBER OF COUPLES	EFFECTIVENESS ³ OF METHODS USED "LAST"				
		Total	Very Effective	Effective	Ineffective	Very Ineffective
Very Effective	319	100.1	81.2	4.4	8.5	6.0
Effective	127	100.0	17.3	74.8	2.4	5.5
Ineffective	309	100.0	33.0	13.6	48.2	5.2
Very Ineffective	327	99.9	38.5	11.3	11.6	38.5

Table 27. Percentage distribution of methods of contraception used first by methods used "last" in relation to the effectiveness of the methods, for "relatively fecund" couples.¹

¹ Only couples whose first and "last" methods were known and appeared among the twenty-two methods coded are presented here.

² The criteria for these classifications for both first and "last" methods used are the ineffectiveness ratios for "relatively fecund" couples (all pregnancies) which appear in Table 25. The intervals are as follows: "Very Effective," under 6 per cent; "Effective," 6 to 9.9 per cent; "Ineffective," 10 to 13.9 per cent; and "Very Ineffective," 14 per cent or over.

the use of less effective to the use of more effective methods of contraception. Since the methods being used "last" by the couples (i.e., the last method used before the couples were interviewed) is the best available net index of acceptability, the correlations between methods used first and effectiveness, and methods used "last" and effectiveness, are of direct relevance. These correlation coefficients are $-.57$ and $+.82$, respectively;⁷⁵ they indicate a distinct tendency to use less effective methods at the beginning of contraceptive practice and to change to more effective methods during the 12 to 15 years of married life covered by this study. In other words, in so far as "acceptability" is reflected in the "last" method used, its merging with "effectiveness" appears to be very high.

Since correlation coefficients do not relate in detail the relationship between change in method and effectiveness, the twenty-two methods have been grouped into four categories according to their observed effectiveness in order to present some of this detail. From Table 27, the extent of the change from ineffective to effective methods can be seen.⁷⁶ The per-

⁷⁵ See Table 13 for the actual proportions that were ranked by method.

⁷⁶ This is not to deny the possibility of changes in method between the first and "last" methods. Some appreciation of these intermediate changes can be gained from Table 13. The data in Tables 27-28 apply only to "relatively fecund" couples (see footnotes to Table 27), for whom the necessity to secure an effective method is a more pressing consideration than for couples having some history of sterility.

EFFECTIVENESS ¹ OF THE METHODS	METHODS USED FIRST	METHODS USED "LAST"	ABSOLUTE CHANGE	RELATIVE CHANGE
Number of Couples, Total	1,082	1,082		
PER CENT, TOTAL	100.0	100.0		
Very Effective	29.5	47.0	+17.5	+59.3
Effective	11.7	17.4	+ 5.7	+48.7
Ineffective	28.6	20.1	- 8.5	-29.7
Very Ineffective	30.2	15.5	-14.7	-48.7

Table 28. Percentage distribution of "relatively fecund" couples¹ by effectiveness of method of contraception used first and "last" and changes in these distributions.

¹ See Table 27, footnote 1.

² See Table 27, footnote 2.

centages on the diagonal line (in italics) represent the proportion of couples whose "last" method was in the same class of effectiveness as their first method. It is apparent that the last method used by the highest proportion of couples is in the same category of effectiveness as the first method used.⁷⁷ However, there is a definite downward trend in these proportions with decreasing effectiveness. Thus, while 81 per cent of the couples using "very effective" methods at the beginning were using "very effective" methods at the interview, less than 39 per cent of the couples beginning with "very ineffective" methods were using these same methods at the time the study was made. In fact, an equal percentage had turned to "very effective" methods. In Table 28, a comparison of the net change in the use of methods varying in effectiveness is presented. It is readily apparent that there was a substantial increase⁷⁸ in the use of more effective methods during the period of years under consideration. On the other hand, it is significant that over 35 per cent of this group were still using comparatively ineffective contraceptive methods at the end of this period.

SUMMARY

This study is based on an analysis of the pregnancy and contraceptive histories which were recorded in the Indianapolis

⁷⁷ The percentage is the same as that for the "very ineffective" category.

⁷⁸ Statistically significant at the 1 per cent level.

Study. Unlike many of the previous reports in this series, it does not relate to a specific hypothesis but rather to the practice of contraception in a modern American city. Attention is focused particularly on the effectiveness and acceptability of a number of different contraceptive methods. Analysis of the data in terms of economic status elucidates more fully some of the factors underlying group differences in fertility. The following observations, although varying in their degree of substantiation, can be stated as the main findings of this study.

(a) There appears to be no systematic relationship between fecundity and economic class. There are, however, wide variations in the noncontraceptive pregnancy rates, in this study and in some other studies, which seem to indicate conclusively that more statistical research in this biological area is necessary.

(b) In the period of exposure to the risk of conception before the first pregnancy there is a direct relation between economic class and the proportion of the period covered by contraceptive practice. After the first pregnancy there is no relationship between the two at all. Because of the greater statistical weight of the "after first pregnancy" exposure, this lack of relationship persists for the total period of all exposure. There is definite evidence, however, of an inverse association between economic class and the regularity of use.

(c) Pregnancy rates during periods when contraception is practiced vary inversely with economic class.

(d) This variation is due primarily to the differential use of methods of contraception which themselves vary in effectiveness but also to the differential proficiency with which any method is used. This observation should not be interpreted as an explanation of all differential fertility in the United States, however, because of the limits imposed in the sample design on the socio-economic and other characteristics of the respondents.

(e) Condom and some kind of douche used separately or together account for approximately 72 per cent of all exposure

with contraception for the total group studied. Diaphragm and jelly, which accounts for about 7 per cent of all contraceptive exposure, tends to be used later in the marriage period than condom and douche. There is a definite increase in the use of more effective methods over the marriage period, although over 35 per cent of the couples were using comparatively ineffective methods after 12 to 15 years of marriage.

(f) The belief that a method offered "reliability" is the chief reason both for using a method and for changing from one method to another.

(g) For "relatively fecund" couples using contraception "always," contraception in general is 92 per cent effective from the point of view of the reduction in uncontrolled fertility.

(h) Individual methods of contraception vary widely in their effectiveness. They range from the highly effective methods of diaphragm and jelly, condom, and condom combined with douche to the least effective methods of the safe period, suppository, and douches. These differences support, in general, the results of previous studies on this subject.

APPENDIX I

Table 29. Number of years of exposure¹ with different methods of contraception when contraception was practiced "always," for "relatively fecund" couples by income, and for "relatively sterile" couples.

METHOD OF CONTRACEPTION ²	"RELATIVELY FECUND"						"RELATIVELY STERILE"	
	Before First Pregnancy			After First Pregnancy			Before First Pregnancy	After First Pregnancy
	Income of Couple			Income of Couple				
	High	Medium	Low	High	Medium	Low		
All Methods, Total	1,156	1,331	587	1,550	3,497	3,734	552	755
Douches, All Kinds Used Strictly	385	469	202	235	668	1,166	300	379
Douches, Water	106	93	104	51	210	303	96	72
Douches, Lyeol	47	119	78	56	242	331	26	13
Douches, Salt and/or Soda	31	45	21	26	149	134	51	36
Douches, Zonite	67	58	0	31	67	13	29	1
Douches, Other	134	154	89	71	300	385	98	197
Condom	218	306	104	342	823	746	107	165
Withdrawal	75	27	28	76	92	226	8	21
Diaphragm and Jelly	57	49	0	222	306	308	4	34
Suppository	1	27	32	69	110	165	16	35
Jelly	6	0	0	83	38	20	0	0
Safe Period	24	10	18	22	17	15	2	11
Condom and Water Douches	53	49	3	103	189	120	21	5
Condom and Lyeol Douches	9	6	*	72	148	35	0	0
Condom and Other Douches	65	118	18	39	173	113	0	51
Withdrawal and Douches	12	40	29	46	64	64	3	29
Diaphragm, Jelly, and Douches	3	0	0	20	42	18	0	0
Suppository and Douches	33	48	2	25	91	57	19	4
Safe Period and Douches	13	3	7	10	61	32	0	2
Condom or Douches	55	64	10	86	113	243	42	6
Condom or Douches, or Condom and Douches	31	16	36	35	98	120	30	26
Condom or Withdrawal	82	73	4	59	96	173	0	7
Withdrawal or Douches, or Withdrawal and Douches	34	26	4	6	38	113	0	40

¹ Less than 6 months of exposure.² These figures have been rounded off to the nearest year.
³ See Table 5, footnotes 2-9.

Table 30. Number of conceptions with different methods of contraception when contraception was practiced "always" for "relatively fecund" couples by income, and for "relatively sterile" couples.¹

METHOD OF CONTRACEPTION	"RELATIVELY FECUND"						"RELATIVELY STERILE"	
	Before First Pregnancy			After First Pregnancy			Before First Pregnancy	After First Pregnancy
	Income of Couple			Income of Couple				
	High	Medium	Low	High	Medium	Low		
All Methods, Total	75	132	151	100	251	498	50	38
<i>Diaphragm, All Kinds Used Singly</i>	54	88	105	42	113	228	39	11
Douche, Water	14	25	30	20	31	68	4	1
Douche, Lyol	14	27	28	8	33	71	10	4
Douche, Salt and/or Soda	4	5	17	2	3	39	4	1
Douche, Zonite	2	9	—	2	8	1	2	1
Douche, Other	17	22	30	10	38	49	19	4
Condom	7	13	10	18	45	39	2	3
Withdrawal	1	0	8	3	6	14	0	0
Diaphragm and Jelly	0	1	—	6	8	20	0	6
Suppository	0	1	6	2	12	38	2	1
Jelly	2	—	—	2	9	1	—	—
Safe Period	4	0	3	4	5	10	0	0
Condom and Water Douche	2	3	1	3	8	15	0	0
Condom and Lyol Douche	0	1	1	0	2	9	—	—
Condom and Other Douche	0	2	1	3	6	5	—	0
Withdrawal and Douche	0	3	0	2	4	6	0	2
Diaphragm, Jelly, and Douche	0	—	—	0	2	2	—	—
Suppository and Douche	0	5	2	2	6	20	2	0
Safe Period and Douche	2	0	0	1	1	3	—	0
Condom or Douche	1	10	3	4	8	45	1	1
Condom or Douche, or Condom and Douche	2	2	6	3	5	5	4	2
Condom or Withdrawal	0	0	2	2	3	21	—	0
Withdrawal or Douche, or Withdrawal and Douche	3	3	3	3	8	17	—	12

— No exposure

¹ See Table 5, footnotes 2-9.

Table 31. Number of years of exposure¹ with different methods of contraception when contraception was practiced "usually" or "sometimes," for "relatively fecund" couples by income, and for "relatively sterile" couples.

METHOD OF CONTRACEPTION ²	"RELATIVELY FECUND"						"RELATIVELY STERILE"	
	Before First Pregnancy			After First Pregnancy			Before First Pregnancy	After First Pregnancy
	Income of Couple			Income of Couple				
	High	Medium	Low	High	Medium	Low		
All Methods, Total	56	129	85	58	203	306	215	231
Douches, All Kinds Used Singly	35	69	61	23	71	106	100	112
Douche, Water	15	11	17	0	8	7	55	34
Douche, Lysol	13	17	9	5	13	27	14	16
Douche, Salt and/or Soda	0	4	2	0	0	32	24	20
Douche, Zonite	1	2	*	5	12	*	6	0
Douche, Other	6	35	33	3	38	40	81	42
Condom	14	33	17	13	50	39	4	53
Withdrawal	0	1	1	0	3	17	6	3
Diaphragm and Jelly	0	0	0	4	0	25	0	0
Suppository	0	2	0	0	2	35	1	13
Jelly	0	0	0	10	1	0	0	27
Safe Period	0	0	0	0	1	0	0	16
Condom and Water Douche	0	1	*	*	0	1	0	2
Condom and Lysol Douche	0	*	0	0	0	1	*	0
Condom and Other Douche	0	0	0	0	0	1	4	0
Withdrawal and Douche	0	0	0	0	1	0	0	0
Diaphragm, Jelly, and Douche	0	0	0	0	0	0	0	0
Suppository and Douche	0	0	1	0	24	3	0	5
Safe Period and Douche	0	*	0	0	0	0	0	0
Condom or Douche	3	0	*	6	19	35	20	0
Condom or Douche, or Condom and Douche	0	4	0	0	0	16	0	0
Condom or Withdrawal	3	0	*	0	11	19	0	0
Withdrawal or Douche, or Withdrawal and Douche	1	19	5	12	*	8	0	0

² Less than six months of exposure.¹ These figures have been rounded off to the nearest year.³ See Table 5, footnotes 2-9.

Table 32. Number of conceptions with different methods of contraception when contraception was practiced "usually" or "sometimes," for "relatively fecund" couples by income, and for "relatively sterile" couples.¹

METHOD OF CONTRACEPTION	"RELATIVELY FECUND"						"RELATIVELY STERILE"	
	Before First Pregnancy			After First Pregnancy			Before First Pregnancy	After First Pregnancy
	Income of Couple			Income of Couple				
	High	Medium	Low	High	Medium	Low		
All Methods, Total	29	57	59	22	66	127	33	50
<i>Douches, All Kinds Used Singly</i>	23	39	36	4	29	57	28	25
Douches, Water	6	12	15	—	7	7	5	5
Douches, Lysol	5	7	10	0	8	28	10	5
Douches, Salt and/or Soda	—	6	2	—	—	6	2	4
Douches, Zonite	6	6	1	2	2	1	0	—
Douches, Other	6	8	8	2	12	17	6	1
Condom	2	4	9	7	11	18	4	24
Withdrawal	—	2	1	—	7	11	0	10
Diaphragm and Jelly	—	—	—	2	—	2	—	—
Suppository	—	3	—	—	5	3	0	0
Jelly	—	—	—	2	1	—	—	0
Safe Period	—	—	—	—	2	—	—	1
Condom and Water Douche	—	2	1	3	—	1	—	0
Condom and Lysol Douche	—	2	—	—	—	1	1	—
Condom and Other Douche	—	—	—	—	1	1	0	—
Withdrawal and Douche	—	—	—	—	4	—	—	—
Diaphragm, Jelly, and Douche	—	—	3	—	1	3	—	0
Suppository and Douche	—	1	—	—	—	—	—	—
Safe Period and Douche	—	—	—	—	—	—	—	—
Condom or Douche	2	—	3	3	1	11	0	—
Condom or Douche, or Condom and Douche	—	2	—	—	—	7	—	—
Condom or Withdrawal	2	—	1	—	3	8	—	—
Withdrawal or Douche, or Withdrawal and Douche	0	2	5	1	1	4	—	—

— No exposure.

¹ See Table 5, footnotes 2-9.

APPENDIX II

A NOTE ON THE CONCEPT OF THE "EFFECTIVENESS RATIO"

A basic theoretical problem involved in the concept of the effectiveness ratio relates to the type of noncontraceptive pregnancy rate to be selected for a standard. The effectiveness ratio purports to measure the reduction in risk below the level expected *when no contraception is used*. As indicated in the text, however, there are several types of noncontraceptive exposure. The choices actually available in this study are based on (1) exposure before the first use of contraception; (2) exposure following the interruption of contraception for purpose of conception; or, (3) both (1) and (2). For reasons that will become clear in the following discussion, the real choice lies between (1) and (3).⁷⁹

The accepted procedure in the past has been to rely upon exposure before the first use of contraception. The fact that previous investigators have never seriously raised the question of combining temporary noncontraceptive exposure with the more "habitual"⁸⁰ type is more readily understandable in view of the fact that most former studies of contraception and fertility were restricted to birth-control clinic populations where the planned pregnancy was a very infrequent occurrence.

To facilitate the following discussion, let the abbreviation BC (before contraception) signify exposure before the first use of contraception, and IC (interrupted contraception) for exposure after contraception has been interrupted in order to have a child. The total BC+IC would then stand for all noncontraceptive exposure.

Although the authors of this present study utilized the BC exposure rate as the standard for computing "expected" pregnancies, the decision is not completely satisfactory. For some time the desirability of using the BC+IC pregnancy rate as a noncontraceptive

⁷⁹ As stated in the text there is logically another type of noncontraceptive exposure, namely, exposure following the interruption of contraception for purposes other than to conceive. This exposure, however, is statistically negligible in this study, and as far as can be determined, has been also insignificant in previous studies. Nevertheless, it should be included, when present, in a standard of total noncontraceptive exposure. For purposes of simplification, this type of exposure is ignored in this discussion.

⁸⁰ Stix and Notestein's terminology.

standard was discussed, since it has several features to recommend its use over the BC rate alone. First, it does represent the actual total noncontraceptive experience of the group. This consideration assumes greater importance when it is recalled that the pregnancy rates for the two types of exposure differ significantly and widely (see Table 3). It may be that the combined rate more adequately reflects the "true" reproductive capacity of the group.

A second consideration which warrants attention is the possibility that couples who do not adopt contraception until late in marriage or who never adopt it, and hence who contribute heavily to BC exposure, are less fecund than couples who start practicing contraception early in marriage and who, when they want a child, are able to conceive on an average of every 4.5 exposure-months. The corresponding average number of exposure-months per conception for couples during BC exposure is 8.0 months, a period almost twice as long.⁸¹ These problems, which recur repeatedly in studies of this nature,⁸² simply reiterate the necessity of detailed statistical research on the subject of chance of conception in the absence of contraception during different periods of married life, in different pregnancy intervals, and with differences in motivation.

A third possible advantage that the combined BC + IC standard may have over the simple BC standard, is that BC exposure is related inversely, and IC exposure is related directly, to economic status. (See Table 1.) If it could be asserted unequivocally that fecundity is completely unrelated to socio-economic status, this would present no problem. Although the data in this and many of the previous studies show no systematic group relationships, there are statistically significant variations in noncontraceptive pregnancy rates among the classes⁸³ which have not yet been explained adequately. Consequently, the possible neutralization of these opposing relationships in a combined rate deserves at least preliminary consideration in any study.

⁸¹ These averages are for "all pregnancies" for "relatively fecund" couples. The averages by pregnancy order are: first: pregnancy, BC—6.1, IC—3.8; for later pregnancies, BC—11.9, IC—5.1.

⁸² For an emphasis of this criterion, see Tietze, Guttmacher, and Rubin: *Time Required for Conception in 1,727 Planned Pregnancies*. *Op. cit.*, p. 341.

⁸³ The fact that "class" has been measured operationally in the study by income groupings instead of by a more sophisticated sociological criterion which would reflect more accurately the vast network of differences in ways of life and differential value-systems, further complicates any inferences of "class" variations in fecundity.

In spite of these considerations, which argue strongly for a combined standard, it was decided in this study to compute the "expected pregnancies" factor on the basis of the simple BC rate. Several reasons for this decision can be enumerated. The primary reason is that this procedure was followed in previous studies; hence its use here facilitates comparisons.

Another consideration, alluded to briefly above, is that since postpartum amenorrhea and lactation are normal processes they should affect in some degree the risk of conception after the first pregnancy, instead of being minimized as they would be if the combined standard were employed.

Regardless of the type of standard adopted there is always the problem of estimating for the couples who practiced contraception the pregnancy history which they would have had in the absence of contraceptive practices. This problem is especially serious in studies of urban populations like the present where noncontraceptive experience of the BC exposure-type accounts for only 2.8 per cent of the total exposure of "relatively fecund" couples. (See Table 1.) It is considerably less serious in birth-control clinic populations where many of the couples coming to the clinic for contraceptive advice have had much BC exposure.

It is perhaps ironic that these various theoretical considerations are reflected so little in the actual percentage values of the effectiveness ratios. The following illustration, among other things, serves to underscore the insensitive nature of these ratios. Assume that the choice is between a BC rate of 200, and a BC + IC rate of 300. Given the contraceptive pregnancy rates of 5 for Method A, 10 for Method B, and 25 for Method C, the effectiveness ratios would be as follows:

	Ratio Based on BC Standard	Ratio Based on BC + IC Standard
Method A	98	98
Method B	95	97
Method C	88	92

The differences between the ratios for the two standards are not very impressive particularly in view of the relative differences between the two noncontraceptive rates and between the three rates

for the different methods. This insensitivity of the effectiveness ratio is particularly apparent where the contraceptive rates are low and the noncontraceptive rates are very high. Furthermore, a moment's reflection will show that the rank-order relationship of the different methods remains identical regardless of which noncontraceptive standard is chosen.

In conclusion, it is our opinion that although the effectiveness ratio to some extent portrays accurately the over-all reduction in the risk of conception⁸⁴ from an abstract demographic point of view, it is so beset with conceptual and perceptual difficulties that its use in comparisons of the effectiveness of different methods, particularly if the data are to be evaluated from a personal point of view, is seriously open to question.

⁸⁴ An advantage of the effectiveness ratio is that it provides a better basis than pregnancy rates for comparison of the effectiveness of various methods as shown in different studies. A direct comparison of pregnancy rates for a given method as shown in different studies will only be valid if the fecundity of the two populations is the same. There are reasons for believing, however, that the fecundity of birth-control clinic populations is higher than that of a "normal" population. For example, the Stix and Notestein study reveals BC rates of 271 and 105 for first and subsequent pregnancies and IC rates of 444 and 331 (*op. cit.*, p. 184) compared to the corresponding rates of 195 and 101, and 314 and 236 for the "relatively fecund" couples in the Indianapolis Study. The rates for "all couples" in the Indianapolis Study are much lower (36 and 41 for BC exposures, 59 and 98 for IC exposure) because couples with varying degrees of sterility are included. Thus, the effectiveness ratio serves to standardize pregnancy rates for differences in fecundity and to increase comparability.

It should be recognized that the effectiveness ratios that appear in this study are quite different conceptually from the ratios previously computed by Whelpton and Kiser, *op. cit.*, vi. The Planning of Fertility, pp. 103-107 (Reprint pp. 249-253); and *op. cit.*, viii. The Comparative Influence on Fertility of Contraception and Impairments of Fecundity, pp. 182-236 (Reprint pp. 303-357). The major difference between the Whelpton and Kiser ratios and those in this article are that the former measure the "observed" factor in terms of the actual number of pregnancies and live births that occurred regardless of whether they were planned or unplanned and thus constitute an estimate of the reduction in group fertility due to attempts to plan births but a reduction in which noncontraceptive fertility is allowed for. Our ratios, on the other hand, are only concerned with the reduction in fertility that occurs as measured against the number of pregnancies conceived unintentionally while contraception was practiced and does not include noncontraceptive conceptions in the "observed" factor. This accounts for the lower ratios of Whelpton and Kiser, averaging around 70 per cent, compared to those in this study of around 90 per cent (*see* Table 26).

ANNOTATIONS

DEMOGRAPHIC YEARBOOK, 1952¹

THE general nature of the DEMOGRAPHIC YEARBOOK, published by the Statistical Office of the United Nations, has been described in previous annotations of the *Quarterly*.² As described by the editors, "Most of the statistics presented in the *Demographic Yearbook* are derived from questionnaires sent by the Statistical Office of the United Nations to the governments or administrations of all the geographic units or 'countries' of the world."³ Each successive issue covers a series of basic topics. However, a rotating scheme is used whereby a given topic is treated in special detail in each issue. Thus, data on marriage and fertility were employed in the 1949-50 volume and data on mortality were stressed in the 1951 issue. "The present (1952) issue of the *Demographic Yearbook* is concerned mainly with recent data on the geographic distribution of population and draws heavily upon results of the 1950 and 1951 censuses of population. The statistical tables deal with the following aspects of the general subject: distribution of the population by major civil divisions; urban and rural population, by sex; population of agglomerations or localities, classified by number of inhabitants; and the population of each city of 100,000 or more inhabitants and of each national capital or major administrative centre. A chapter on urban trends and characteristics is also included."⁴

¹ United Nations Statistical Office. DEMOGRAPHIC YEARBOOK, Fourth issue, 1952, New York, 518 pp. \$7.50 (cloth), \$6.00 (paper).

² Milbank Memorial Fund *Quarterly*, January, 1952, xxx, No. 1, pp. 91-93, and October, 1952, xxx, No. 4, pp. 391-395.

³ DEMOGRAPHIC YEARBOOK, Fourth issue, 1952, p. 7.

⁴ *Ibid.*, p. 7.

Although its central theme is geographic distribution, the last volume of DEMOGRAPHIC YEARBOOK contains one new table on divorce rates and two new tables "presenting statistics of resettlement and repatriation of refugees under the auspices of the International Refugee Organization."

DEMOGRAPHIC YEARBOOK has been a boon to students of population and vital statistics throughout the world. Its publication provides them a stream of up-to-date demographic statistics and it is helping to stimulate various countries to improve their national statistical systems.

CLYDE V. KISER

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PRELIMINARY REPORT ON THE WORLD SOCIAL SITUATION¹

THIS recent report by the United Nations' Department of Social Affairs, despite its somewhat ambitious title, is a carefully documented inventory and analysis of selected social conditions throughout the world. This publication is the result of an invitation to the Economic and Social Council by the General Assembly to prepare a report outlining and summarizing the world's social needs by analyzing data available to the United Nations that is collected in the course of its official duties. Reliance on limited secondary sources is, of course, a serious restriction. This and other limitations, inherent both in the organization and scope of the project, are enumerated fully in the Preface and throughout the various chapters. Especially crucial are problems of the reliability of the data, its incompleteness, and the comparability of the statistics.

The report is organized around the following topics: population, health, food and nutrition, housing, education, work and employment conditions, and standards of living. Relying primarily on quantitative indices of these phenomena, the appropriate statistics for each cooperating nation are presented and discussed in a manner which enables comparison. In order to delimit the scope of the inquiry, attention is focussed on exist-

¹ United Nations, Department of Social Affairs. *PRELIMINARY REPORT ON THE WORLD SOCIAL SITUATION*. New York, 1952, 180 pp.

ing social needs and conditions to the exclusion of any systematic attempt to evaluate the actual or potential effects of programs which are designed to alleviate depressed conditions where they exist. The net effect of these comparisons is to indicate vividly the existing differentials and inequalities of levels of living throughout the world. A comparison of national populations on the basis of a number of objective indices of *levels* of living cannot of course as the report admits, be regarded unqualifiedly as an accurate evaluation of national *standards* of living. In other words, the more elusive cultural evaluations of these situations must be regarded as mitigating factors. This type of information is not easily accessible, to say the least. Nevertheless, the objective situations reflect clearly the existence of discrepancies so great that no amount of cultural relativism could satisfactorily account for them. Although a great deal has been accomplished comparatively in recent decades, especially in the so-called "underdeveloped" areas of the world, this report indicates that in the economic area the "gap between the rich and the poor countries in general levels of production and consumption is wider than before the Second World War" although in terms of distribution a leveling process can be discerned.

The subjects discussed are treated unevenly. The chapter on Education, for example, is far more extensive and detailed than the chapter on Housing. These differences of emphasis are at least partly due to differences in the amount of information available on the various subjects. One weakness of the analysis, which is due probably to the division of labor in its production, is a noticeable lack of integration of the interrelated subjects that are presented. Only once in the report is this referred to at any length (in a theoretical context) and only very briefly in the space of two pages (pp. 134-135). Probably in a volume which attempts to cover so much territory in so little space this is to ask too much. The authors of the report are quite aware of the problem. A form of integration at a different level is accomplished in the last three chapters which present a regional approach to social conditions in Latin America, the Middle East, and South and Southeast Asia.

No effort can be made in this review to summarize any of

the substantive findings of this research. Perhaps the general "tone" of these findings can be stated in the words of the authors' comment concerning the shifting picture of disease and death (in the Chapter on Health) which "shows that there are no frontiers to our health problems, only a succession of horizons."

This carefully prepared and well-written report performs the very useful service of bringing together in a single volume an up-to-date series of succinct summaries of social trends in all areas of the world in a form which facilitates international comparisons.

CHARLES F. WESTOFF

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A STUDY OF THE AETIOLOGY OF CARCINOMA OF THE LUNG¹

FROM 1948-1952, a large-scale investigation was conducted in England to obtain a better understanding of the etiology of carcinoma of the lung. The first results of this study were reported in a paper written by Doll and Hill in 1950. At this time the authors came to the conclusion that smoking was a factor in the production of lung cancer. In 1950 the study was extended to other parts of the country and more detailed information on smoking habits was obtained. This second paper presents an analysis of all of the material collected by the authors.

During the four years of the study nearly 5,000 patients were interviewed in hospitals in Bristol, Cambridge, Leeds, Newcastle-upon-Tyne, London, Dorset, and Wiltshire. The authors were notified of all patients admitted to these hospitals who had cancer of the lung, stomach, or large bowel. At the beginning of the study, patients with carcinoma of the stomach or large bowel comprised one control group; another group of controls consisted of patients who had diseases other than cancer. Since these two groups were found to be quite similar in their smoking histories, in the second half of the study the

¹ Doll, Richard and Hill, A. Bradford: A Study of the Aetiology of Carcinoma of the Lung. *British Medical Journal*, December 13, 1952, II, p. 1271.

control group was comprised of patients drawn from both of these groups.

Each control patient was chosen to match a lung-carcinoma patient in the same hospital. The control had to be of the same sex and within the same five year age group as the lung-cancer patient.

The major part of the article presents a comparison between 1,465 cases of carcinoma of the lung and their 1,465 matched controls.

All patients were asked a series of questions to see if there was a marked difference in smoking habits between persons with carcinoma of the lung and those who had other diseases. Patients were asked if they had ever smoked; the age at which they began to smoke; the amount they smoked before the onset of the illness which caused them to be hospitalized; the changes, if any, that occurred in their smoking history; if they had ever stopped smoking; the maximum amount they had been in the habit of smoking and whether they inhaled or not.

The authors present an analysis which shows the most recent amount of tobacco smoked regularly before the onset of the patients' present illness. It was found that there were fewer non-smokers and considerably more of the heavier smokers among the lung-cancer patients than the control patients. Of the 1,357 males with carcinoma of the lung, 7 or 0.5 per cent were non-smokers; the corresponding figure among the 1,357 males who had other diseases was 61 or 4.5 per cent. Twenty-five per cent of the males with lung carcinoma had smoked twenty-five or more cigarettes a day, whereas only 13.4 per cent of the control patients smoked that amount. Among the 108 females with carcinoma of the lung, 37.0 per cent were non-smokers compared with 54.6 per cent of their matched controls. For females with lung cancer, 11.1 per cent had smoked twenty-five or more cigarettes a day; for females with other diseases, the corresponding figure was 0.9 per cent.

Doll and Hill then present comparisons of the ages at which patients reported they had started to smoke, the total number of years they had been smoking, and, when applicable, the number of years since they had stopped smoking. On the average, lung-carcinoma patients began smoking earlier, con-

tinued smoking for a longer period of time, and were less inclined to stop than the control patients with other diseases. Among males these differences were all statistically significant. Among females the differences were not significant but showed the same trend and therefore were accepted as real by the authors.

Various methods of smoking are discussed. It was found that 64.6 per cent of the lung-carcinoma patients inhaled as compared with 66.6 per cent of the control patients. The difference was not statistically significant. However, the authors feel that the site of origin of a tumor in the lung may, in some way, be related to inhaling. Males who had peripheral growths inhaled more regularly than did males who developed central growths in the lungs.

Of the 1,350 male lung-carcinoma patients who smoked, 3.9 per cent smoked a pipe only, whereas 74.4 per cent smoked cigarettes only. For male control patients with other diseases, 6.9 per cent were "pure-pipe smokers" and 69.4 per cent smoked cigarettes only. The differences were highly significant and the authors conclude that pipe smoking is not as closely associated with the development of lung cancer as is cigarette smoking. It was also found that the proportion of smokers who used cigarette-holders was significantly smaller among patients with lung cancer than among the control group. The authors believe that a pipe-stem or cigarette-holder may act as a partial filter of a carcinogenic agent.

Doll and Hill also include an analysis of the differences in smoking habits between town and country. As place of residence becomes more urbanized, the proportion of heavy smokers and "pure-cigarette smokers" increases, and this leads to a higher death rate from lung cancer in the towns. However, the authors do not think that smoking "... can wholly explain the different mortality rates between town and country."

The validity of this carefully controlled study is apparent. The data collected subsequent to their preliminary report merely confirm Doll and Hill's previous conclusion that there is a very real association between smoking and carcinoma of the lung.

KATHERINE SIMON

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